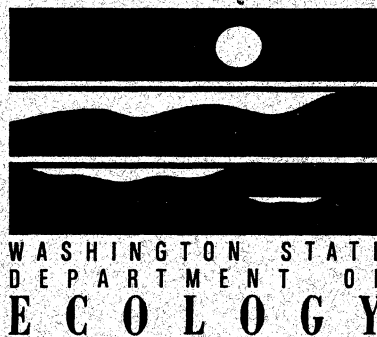


Natural Background Soil Metals Concentrations in Washington State

Toxics Cleanup Program
Department of Ecology



October, 1994
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in

Washington State

by

Charles San Juan

Toxics Cleanup Program

Olympia, Washington 98504-7600

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Executive Summary

This report contains information on the natural background concentrations of metals in surficial soil throughout Washington State. The objective of this study was to define a range of values that represent the natural concentration of metals in surficial soils throughout Washington. The results of this study represent the culmination of a seven-year effort by Ecology (Toxics Cleanup Program) and its co-sponsor, the USGS Water Resources Division (Tacoma Office).

Upon the completion of a small pilot project (Big Soos Creek Drainage Basin, King County, 1987), Washington was divided into 24 distinct regions based on differences in geology, soils, and climate (see **Figure 1**). Twelve of these 24 regions were then selected for a statewide assessment of Washington. These 12 regions were selected because they represent the major urban, industrial, and highly developed core areas in Washington, which is where most cleanup sites are located. Soil samples were then collected from the predominant soil series in each of the 12 regions, with a total of 490 soil samples collected from 166 locations throughout Washington. An effort was made to collect samples from undisturbed or undeveloped areas. Samples were collected from the "A," "B," and "C" soil horizons at each sampling location (ground surface to a depth of 3 ft.). Each sample was analyzed for total metals content.

The results of this study found that the soil metals concentrations in Western Washington were on average slightly higher than Eastern Washington. The population, climate, and vegetation of Western Washington are thought to be the primary reasons for this variation. The variation in west-to-east data are more pronounced when the 90th percentile values are compared (see **Table 1** below). The one exception was arsenic, whose east-side 90th percentile value was 13% higher than the west. Statewide and regional 90th percentile values are presented in **Table 1** below.

Table 1: Statewide & Regional 90th Percentile Values¹

	Al	As ²	Be	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Zn
State Wide	37,200	7	2	1	42	36	42,100	17	1,100	0.07	38	86
Puget Sound	32,600	7	0.6	1	48	36	58,700	24	1,200	0.07	48	85
Clark County	52,300	6	2	1	27	34	36,100	17	1,500	0.04	21	96
Yakima Basin	33,400	5	2	1	38	27	51,500	11	1,100	0.05	46	79
Spokane Basin	21,400	9	0.8	1	18	22	25,000	15	700	0.02	16	66

¹ All Values = mg/kg and represent total-recoverable analysis.

² Graphite furnace atomic absorption (GFAA) analysis.

I. OVERVIEW

Introduction

This report contains the results of a study of natural background soil metals concentrations in Washington State. In this study, 490 soil samples were collected from 166 sites throughout Washington. This study was conducted by the United States Geological Survey (USGS) in cooperation with the Department of Ecology, Toxics Cleanup Program.

What Does "Natural Background" Mean?

"Natural background" is defined in the Model Toxics Control Act (MTCA) (Ch 173-340-200 WAC) as the "...concentration of hazardous substance consistently present in the environment which has not been influenced by localized human activities. For example, several metals occur naturally in the bedrock and soil of Washington State due solely to the geologic processes that formed these materials and the concentration of these metals would be considered natural background. Also, low concentrations of some particularly persistent organic compounds such as polychlorinated biphenyls (PCBs) can be found in surficial soils and sediment throughout much of the state due to global use of these hazardous substances. These low concentrations would be considered natural background. Similarly, concentrations of various radionuclides which are present at low concentrations throughout the state due to global distribution of fallout from bomb testing and nuclear accidents would be considered natural background."

Why is this Study Important?

The advent of hazardous and toxic waste regulation in the United States has prompted a need for both the regulatory and industrial community to better understand the natural concentrations of certain elements in the environment. Consequently, many states, including Washington, have now begun to assess the natural concentration of metals in soils throughout their prospective regions. This study is important in that it represents a true benchmark of the natural background soil metals concentrations in Washington State. These data can be compared against data from known or suspected sites of environmental contamination. More informed decisions on site investigations, cleanup actions, and remedy selections can now be made as a result of the information from this study.

What are the Requirements for Background in the Model Toxics Control Act?

The requirements for determining natural background are given in Ch 173-340-708 (11) WAC of Washington's MTCA. Two types of background values may be determined--"area" and "natural." The derivation of natural background requires the collection of at least ten (10) samples, while the derivation of area background requires at least twenty (20) samples. Samples must be collected from areas that have the same basic characteristics as the medium of concern at the site. Samples must also be collected in areas that "...have not been influenced by releases from the site, and, in the case of natural background concentrations, have not been influenced by releases from other localized

human activities." Statistical methods and detailed guidance on how to derive background values are presented in the publication entitled *Statistical Guidance for Ecology Site Managers* (August, 1992). A computer software program known as "MTCASat" (July 1993) can also be used to derive background values. Copies of the *Statistical Guidance for Site Managers* and MTCASat can be obtained through the Ecology publications office (phone 206 407-7472).

How are Background Values Used?

Background values are often compared against a separate data set for regulatory or investigative purposes. Separate data sets can include data from site investigations, waste streams (sewage, sludge, incinerator ash, fill material), and other background studies. Once the data sets are compared, a decision is then made about whether the foreground data set exceeds the true range of values from the background data set. This decision is typically made using statistics or other mathematical procedures. A summary of potential users for the information from this study is given in Table 2 below.

Table 2: Anticipated Uses of the Background Soils Information

Task	Anticipated Users
Defining Background	Owner/operator of any site that does not want to complete a site-specific background study per MTCA requirements (using this data may be more cost-effective for smaller sites)
Risk Assessments	Toxicologists and other Scientists
Screening Data for Contamination	Ecology staff & Consultants
Analyzing Waste Streams	Generators of hazardous and solid waste, incinerator ash, fill material, and sewage sludge
Designing Investigative Studies	Consultants
Regulatory Compliance	Federal Programs including RCRA and Superfund, state biosolids and sewage sludge programs, health departments
Research	Universities and other organizations
General Information	Public, Attorneys, etc.

Background Soil Metals - Other Studies

The intent of this section is to provide some brief information on what other states and organizations have done regarding background investigations. It is hoped that this information can be used primarily for comparative purposes.

United States Geological Survey (USGS)

Schacklette and Boerngen (1984) of the USGS initiated one of the first studies of elements in soil throughout the United States. In their paper, Schacklette and Boerngen state that at the beginning of the study (1961), "...few data were available on the abundance of elements in surficial materials of the United States as a whole." They also went on to state that "...most of the early reports discussed only the elements that were of economic importance to mining or agriculture in a metallogenic area or State..." Thus, Shacklette designed a study to "...give estimates of the range of elemental abundance in surficial materials that were unaltered or very little unaltered from their natural condition." This led to the collection of soil samples from 1,318 sampling locations across the United States at depths of approximately 20 cm.

Washington

Increased awareness of environmental affairs and concern over industrial pollution in the United States has led to more need to understand the natural concentrations of certain elements in the environment. This trend has taken hold in Washington State, as noted by the 1989 PTI Environmental Services study entitled *Background Concentrations of Selected Chemicals in Water, Soil, Sediments, and Air of Washington State*. This study (performed by PTI for the Department of Ecology), was designed to identify "...the concentrations of high-priority contaminants that are representative of background (or ambient) conditions in the water, soil, and air of Washington state." The information from this study was ultimately used in the development of cleanup standards for the Model Toxics Control Act (MTCA).

The advent of hazardous waste regulation and cleanup of sites contaminated with toxic wastes in the United States has also prompted the need to understand the natural concentration of elements in the environment on a site-specific basis. A good example of this is the April 1993 study conducted by the United States Department of Energy for the Hanford Nuclear Reservation. This study involved the collection of over 180 soil samples at 14 locations throughout the Hanford site. Information from this study will ultimately be used in the environmental remediation and restoration effort at the Hanford site.

Similar site-specific investigations into background metals concentrations have been conducted at the Asarco Smelter Superfund site in Tacoma and the former Dupont Works site in Dupont. For the Asarco study, 25 samples were collected from McChord Air Force Base to determine the background concentrations of inorganics in soil (ICF & Ecology, April 1993). The natural or "ambient" concentration of arsenic in soil in and around the Asarco Smelter has been a high-priority item for several years now. A number of samples have also been collected to assess the natural concentration of mercury and other inorganic constituents at the Dupont site.

Michigan

The Michigan Department of Natural Resources (MDNR) completed a study of natural background soil metals concentrations in September 1988. An update to this study was completed in April 1991.

The background data from Michigan's study was originally intended for comparison against data from hazardous waste site closures (RCRA); however, the data set has been widely distributed and is currently being used at Michigan toxic waste cleanup sites as well. In Michigan, natural background values are generated by calculating the mean plus three standard deviations. For more information on the Michigan study, contact Dave Slayton, Senior Geologist, Geotechnical Unit, MDNR Waste Management Division at (517) 373-8012.

New Jersey

The New Jersey Department of Environmental Protection has published information available on the concentrations of metals and organics in soil at background locations throughout the state (ref: "A Summary of Selected Soil Constituents and Contaminants at Background Locations in New Jersey", New Jersey DEP, September, 1993). In this study, 80 soil samples were collected from 46 of the most common soil types found in New Jersey. Background concentrations are given according to five land use categories: urban, suburban, rural, golf course, and farm. Statistical or regulatory requirements for determining background are not given in the report; however, 90th percentile values are given for each land use category.

Ontario, Canada

A detailed and comprehensive assessment of background concentrations for both metals and organics in soil is given in Ontario's report entitled *Ontario Typical Range of Chemical Parameters in Soil, Vegetation, Moss Bags and Snow* (Ontario Ministry of Environment and Energy, December, 1993). Data on background soil metals concentrations have been compiled using the 98th percentile or Ontario Target Range (OTR₉₈). The 98th percentile was selected because it represents the mean plus two standard deviations of a normally distributed population. Ontario has also decided to divide background concentrations into ten land use categories, ranging from old urban residential to rural agricultural (data is currently available for only two land use categories: old urban and rural parkland). For more information, contact Lee Hoffman, PhD Toxicologist, Hazardous Contaminants Branch, at (416) 323-5118.

II. SOIL

What is Soil and How is it Formed?

There are several accepted definitions of soil. A simplistic definition for soil is "...that part of the regolith that can support rooted plants" (Flint, 1977). The term "regolith" literally means "blanket rock" and is defined as the unconsolidated portion of the earth's crust that overlies bedrock. Bushnell (1944) defined soil as a "...natural part of the earth's surface, being characterized by layers parallel to the surface resulting from modification of parent materials by physical, chemical, and biological processes operating under varying conditions during varying periods of time." Soil formation normally can be attributed to five factors: parent material, climate, topography, soil biota (i.e., vegetative cover), and time (Jenny, 1941).

Factors Affecting Soils Formation

The formation of soils is thought to be a weathering process (Thornes, 1979). Reiche (1950) and Keller (1957) defined weathering as "...the response of materials within the lithosphere to conditions at or near its contact with the atmosphere, the hydrosphere, and the biosphere." According to Jenny (1941), the formation and development of soils is controlled by five factors: parent material, climate, topography, soil biota (vegetation), and time. According to Flint (1971), "...the greatest differences among soils now forming are related to climate and vegetation." Specifically, changes in vegetation and soil weathering characteristics correspond to changes in climate and temperature. This trend can be observed across North America. For example, in the dry southwest, the warmer climate evaporates water more quickly, precipitating Ca^{2+} as a carbonate into the "B" soil horizon, producing alkaline conditions. Conversely, in the wet and cold northeast, soluble cations such as Ca^{2+} are transported readily into the soil horizon. The differences in climate and weathering processes in North America form the basis for two primary soil subdivisions: pedocals (calcium-rich, dryer climates) and pedalfers (higher amounts of clay and iron in the "B" horizon, wetter climates).

Washington Soils

The State of Washington is a geologically diverse land mass encompassing over 60,000 square miles. Geologic events over the last 200 million years have brought together several separated subcontinents into what is now Washington. Alt and Hyndman (1984) have since reclassified the State of Washington into six main geologic regions: Olympic Peninsula, Puget Sound Basin, Willapa Hills, Cascade Volcanics and North Cascades, Columbia Plateau, and Okanogan Subcontinent/Kootenay Arc areas.

Effect of Soil and Geologic Diversity on Background

For the purposes of this study, it was recognized that Washington is a geologically diverse state and that determination of background elements in surficial soils could be viewed with skepticism. However, it should again be noted that the formation and development of soils is a process that is

governed primarily by factors other than "geologic diversity;" i.e., the formation of soil is a weathering process affected largely by climate and vegetation. Thornbury (1969) illustrates this point by giving credit to two men, Dokuchaiev of Russia and Hilgard of America. Both of these men felt that given similar topographic, climatic, and vegetative conditions, the soil profile would "...essentially be the same, regardless of variability in parent material." Thus, "geologic diversity" or "variability of parent rock material" may in some cases have minimal impact on the development and the elemental composition of soils. However, Thornbury (1969) also conceded that the thinking on the role of parent material is changing; i.e., "...no pedologist today would maintain that under similar environmental conditions a soil profile developed upon granite would ever be the same as that on limestone."

Summary

This study was designed to measure the background concentrations of metals in soil throughout Washington State. The effects of soil, climate, vegetation and geologic diversity and influences were recognized factors in the conception of this study; however, the definition and measurement of natural background was given top priority. Consequently, the true effects of soils, climate, and geologic diversity upon the results of this study have not been rigorously investigated. Ecology is hopeful that further research on the data from this study will be initiated at some future date.

III. STUDY DESIGN

Objective

The primary objective of this study was to define a range of values that represent the natural concentration of metals in surficial soils throughout Washington State. In order to meet this objective, the Department of Ecology entered into a joint funding agreement with the USGS Tacoma Office to study the ambient concentrations of metals in soils at a series of sites throughout Washington.

Approach

In order to meet the study objective, a small-to-large approach was taken in this study; i.e., a small test site was first investigated and larger areas were gradually added into the scope of work. Thus, the first site to be investigated was a small site in Western Washington known as the Big Soos Creek Drainage basin. This site, which occupies 15 to 30 square miles in southeast King County, was used for the collection of 41 samples at 18 separate locations at depths up to five (5) feet (1987).

Upon completion of the Soos Creek study, the State of Washington was divided into 24 distinct regions based on differences in geology, soils, and climate (see **Figure 1**). Each of these regions was selected by the USGS Water Resources Division. A decision was then made to select 12 of the 24 regions for a statewide natural background soil metals assessment of Washington. The predominant soil series within each of these 12 regions were then sampled (see **Table 3**). A decision was also made to focus additional sampling on the four large urban areas within these 12 regions: Puget Sound Basin, Clark County, Yakima, and the Spokane Basin. The 12 statewide regions and four major urban areas were selected because they represent the major urban, industrial, and highly developed core areas in Washington, which is where most toxic waste sites are located.

Figure 1: Soil Regions of Washington State

(See Table 3 for Regional Description)

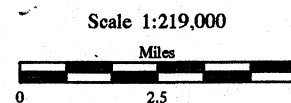
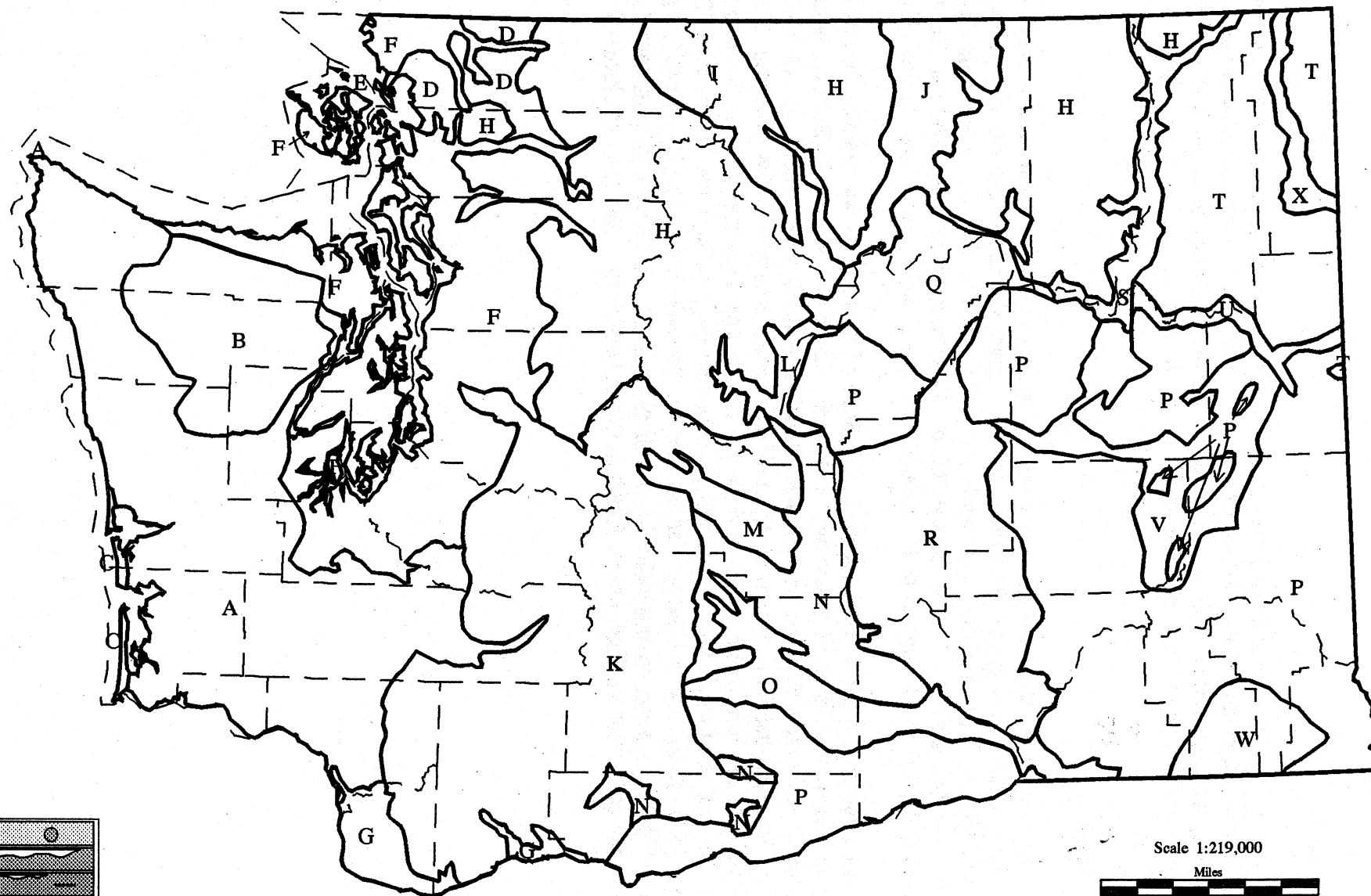


Table 3: Soil and Regional Geologic Descriptions, Statewide Natural Background Study.¹

	Location & Soils Description	Soil Series & Geologic Origin
A	Southwest Washington (Willapa Hills). Developed mainly in continental and marine sedimentary beds along the Pacific Coast (Pringle, 1986). All soils sampled in this Region were developed on upland marine sediments.	Willapa: developed on marine terraces that were cut into marine sediments. Zenker: weathered sandstones. Melbourne: material weathered from marine-deposited siltstone, shale, and fine-grained sandstone.
C	Pacific Coast (Long Beach, Westport, Grays Harbor). Beach sands and "dune lands", i.e. excessively drained ridges formed in fine beach sands.	Netarts: upland areas. Yaquina: basin-like areas between sand dunes (Pringle, 1986).
D	Northern Skagit and Whatcom Counties, Mt. Baker Area. Developed in older sedimentary rocks on the west side of the Cascades (Poulson, 1953).	Cathcart: sandstones and shales. Heisler: glacial moraines in high mountain valleys west of Mt. Baker. Schnorbrush: arkosic sandstone and mountain-side drift material or talus rubble - Nooksack River valley.
F	Puget Sound Basin. Glacial Deposits (till, alluvium, etc.).	Everett: glacial outwash. Spanaway: glacial outwash + volcanic ash.
G	Vancouver-Clark County area. Alluvium derived from a variety of sources.	Lauren: mixed alluvium from Columbia River terraces 50 - 100 ft. above the present river elevation. Wind River: mixed alluvium 150 - 500 ft. above the present river elevation. Sauvie: alluvial bottom lands along the Columbia River. Dollar: terrace deposits. Gee: rolling hills on eroded terraces.
J	Unconsolidated deposits in the Okanogan River Valley.	Colville: mixed alluvium from igneous rocks and volcanic ash. Pouge: terrace deposits, underlain by gravelly sandstones that were deposited as glacial outwash. Cashmere: glacial outwash and more recent alluvium (Lenfesty, 1990)
L	Developed primarily from older sedimentary rocks in the Wenatchee River Valley.	Burch: older alluvium derived from sandstone.
M	Unconsolidated loess and alluvium of the Ellensburg Basin.	Renslow & Selah: loess with caliche layers, underlain by gravel and valley fill. Naches: older valley fill. Reeser: formed over cemented gravels. Wenas: stream bottom material from weathered basalt.
O	Yakima River valley.	Shano & Warden: loess underlain by glaciolacustrine sediments ("Touchet" beds). Weirman: mixed alluvium from flood plains
P	Lincoln-Douglas County area. Thick loess deposits.	Walla & Athena: loess + volcanic ash.
R	Central Columbia Basin. Unconsolidated wind-blown and alluvial material.	Quincy: eolian sands. Shano: loess + volcanic ash. Taunton: wind-worked alluvium.
U	Spokane River Valley.	Marble: wind-worked sandy outwash. Spingdale: outwash mantled with volcanic ash and loess. Ewall & Spens: glacial outwash.

¹ Note: the information in this table was taken from a report prepared by Kenneth C. Ames of the U.S. Geological Survey ("Concentrations of Metals in Soils From Selected Regions in the State of Washington". Draft report, subject to revisions).

IV. SAMPLING

All soil samples were collected by personnel from the USGS Water Resources Division. The Department of Ecology participated in sampling activities at a few locations. All sampling activities took place between June 1987 and January 1993. A brief description of each sampling area and sampling methodology is included in the summaries below. A summary of all sampling activities is presented in Table 4.

Soos Creek Basin, King County

Sixty (60) samples were collected during June 1987 from a 15.9 mi² area immediately north of the Big and Little Soos Creeks confluence. Five (5) sampling sites were located in the Big Soos Creek subbasin and another four (4) were located in the Little Soos Creek subbasin. One shallow sample (0.5 ft.) was collected from these nine locations. Three (3) streambed sediment sampling sites were also located in these subbasins.

Deeper samples (i.e., 5-7 ft.) were collected at selected locations from a backhoe pit. Samples from the "B" and "C" soil horizons were then collected. Shallow samples (0.5 ft.) were collected after first removing the top 1-2" of soil, which contained plant debris and litter. Streambed samples were collected from the upper 1" of locations with fine-grained sand and silt. All of the samples were then sieved for laboratory analysis. For the total-recoverable method, the samples were sieved to particles sizes less than 2 mm.

Statewide Natural Background Assessment

The first phase of this work to be initiated consisted of the collection of sixty (60) samples from the 12 main geologic and urban regions within Washington (5 samples each from regions A, C, D, F, G, J, L, M, O, P, R, U, see Figure 2). The 12-region work was performed during July, August, and September 1990. All of the samples were collected from the "B" or "C" soil horizons that are typically found 2-3 ft. below ground surface. Samples were collected from this zone to minimize the potential effect posed by surface vegetative material on the sampling. The "B" and "C" soil horizons were also selected for sample collection for comparison purposes with toxic waste sites since many of these sites are located in areas where the topsoil has been removed or filled over.

The next phase of work in the statewide assessment involved the collection of samples from the four main urban areas within Washington: Clark County, Yakima Basin, Spokane Basin, and Puget Sound Basin. At each sampling location a shovel was used to dig a 2-ft. wide by 2-ft. deep hole. Each sampling location was consisted of five test pits; i.e., a 2 X 2 ft. test pit was dug at the center and each corner of a 1-acre plot (see Figure 3). A stainless-steel soil auger was then used to collect 1-2 liters of material from the bottom 6 inches of each test pit. Material from each of the five holes was sieved down to particles less than 19.0 mm in size and placed in a 20-liter plastic bucket. The soil samples were then thoroughly mixed to form one composite sample.

Figure 2: Soil Sampling Locations in Washington State

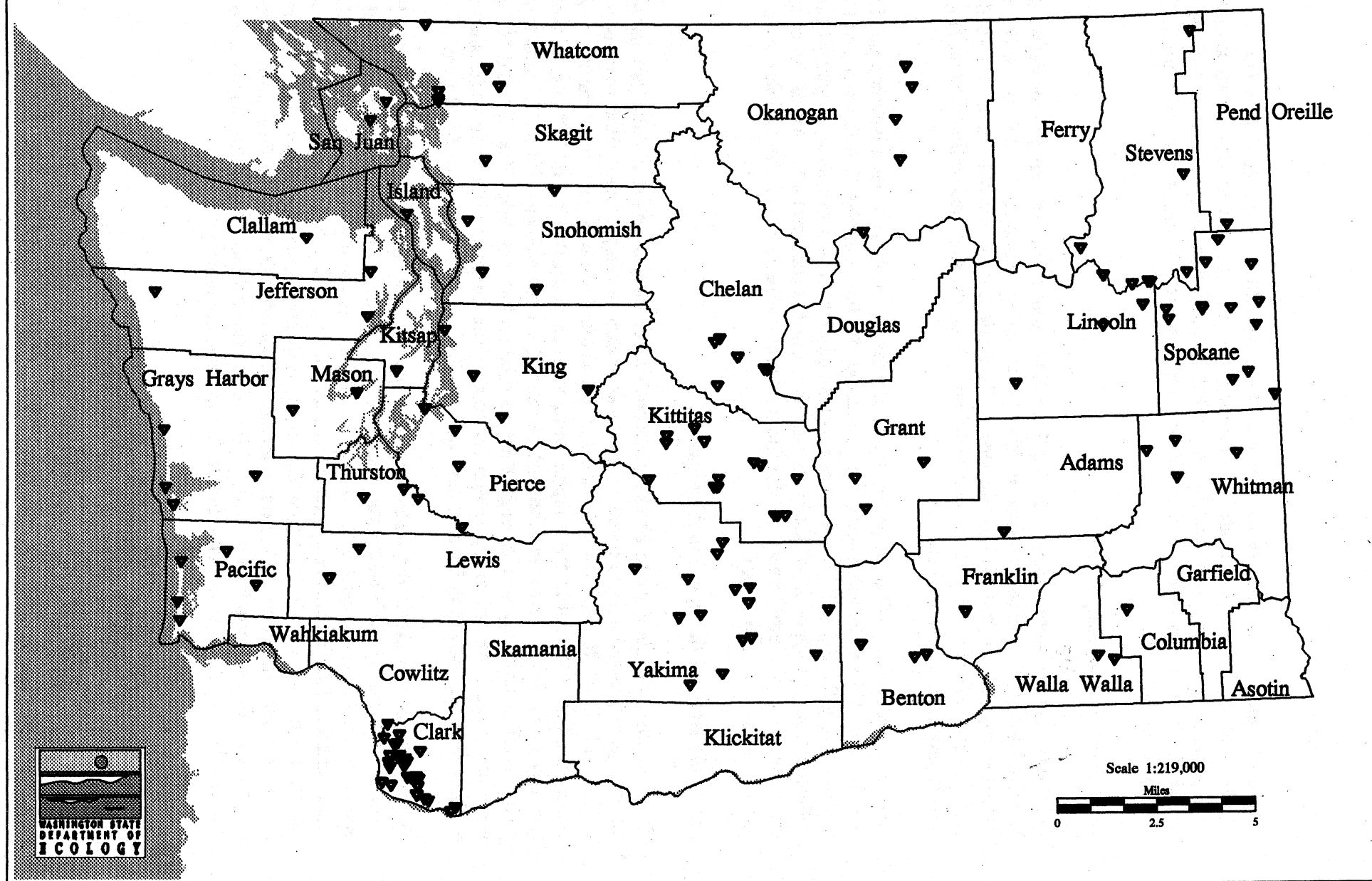


Table 4: Background Soil Metals Sampling Summary

Study	No. of Samples Collected	Sampling Locations	Sample Depths (in.)	Number of Samples Collected per Location	Sampling Procedures	Date
Soos Creek	41	18	up to 60	1-3	Pilot project for natural background study. One shallow sample (0.5 ft.) collected from 9 locations + 3 streambed sediment samples. Deeper samples (5-7 ft.) collected from backhoe pits.	1987
Twelve Region	60	60	20-34	1 (composite of 5 locations within a 1 acre area).	Samples collected from 12 geologically distinct regions in Washington (5 samples per region for a total of 60). Only surficial samples are collected: 2 ft. x 2 ft. test pit dug at the center and each corner of a 1 acre plot, see Figure: (five sampling test pits total). Stainless-steel augur used to collect 1-2 liters of soil from the bottom 6 inches of each test pit. Material from each test pit sieved to < 19.0 mm particle size and thoroughly mixed (composited) in a 20 liter plastic bucket. Soil is then sieved to less than 2 mm at Manchester Laboratory.	1990
Clark ¹ County	81	21	24-36	5 from Vertical Profile "A" 13 from Vertical Profile "B"	Two types of samples collected, surficial (see above description) and "vertical profile". Vertical profile samples were collected from a hand-dug test pit approximately 5-6 ft. deep. An effort is made to sample the "A", "B", and "C" soil horizons. <u>Vertical profile samples were not composited.</u> Two types of vertical profile sampling techniques were used. In Version "A", 5 samples were collected at vertical intervals (samples are collected by standing in the test pit and troweling soil from the "A", "B", and "C" soil horizons). In Version "B", 13 samples are collected; 5 samples are collected from the "center" hand-dug test pit and an additional 8 are collected from 4 sampling locations near the test pit (each corner of a 1-acre plot, 2 samples per location).	1991
Yakima ² Basin	107	22	24-36	5 from surficial, 5 or 13 from vertical profile.	Surficial (five samples collected from a 1 acre plot with a stainless-steel soil augur, 2 ft. depth) and vertical profile (5 or 13 samples collected from a hand-dug test pit, 5-6 ft. deep) samples collected. All samples field-sieved to < 19 mm.	1991
Spokane Basin ³	79	22	24-36	Same as above.	Same as above.	1992
Puget Sound Basin ⁴	122	23	24-36	Same as above.	Same as above.	1993
Total	490	166				

¹ Five (5) samples from Region "G" added for background calculations. ² Ten (10) samples (total) from Regions "M" and "O" added for background calculations. ³ Five (5) samples from Region "U" added for background calculations. ⁴ Five samples from Region "F" added for background calculations.

FIGURE 3: SURFICIAL SOIL SAMPLING SCHEME: 2 X 2 FT. TEST PIT HAND-DUG AT THE CENTER AND EACH CORNER OF A ONE ACRE PLOT. STAINLESS STEEL SOIL AUGER USED TO COLLECT 1-2 LITERS OF SOIL FROM THE BOTTOM 6" OF EACH HOLE. ALL 5 SAMPLES WERE THEN COMPOSITED TO FORM ONE SAMPLE.

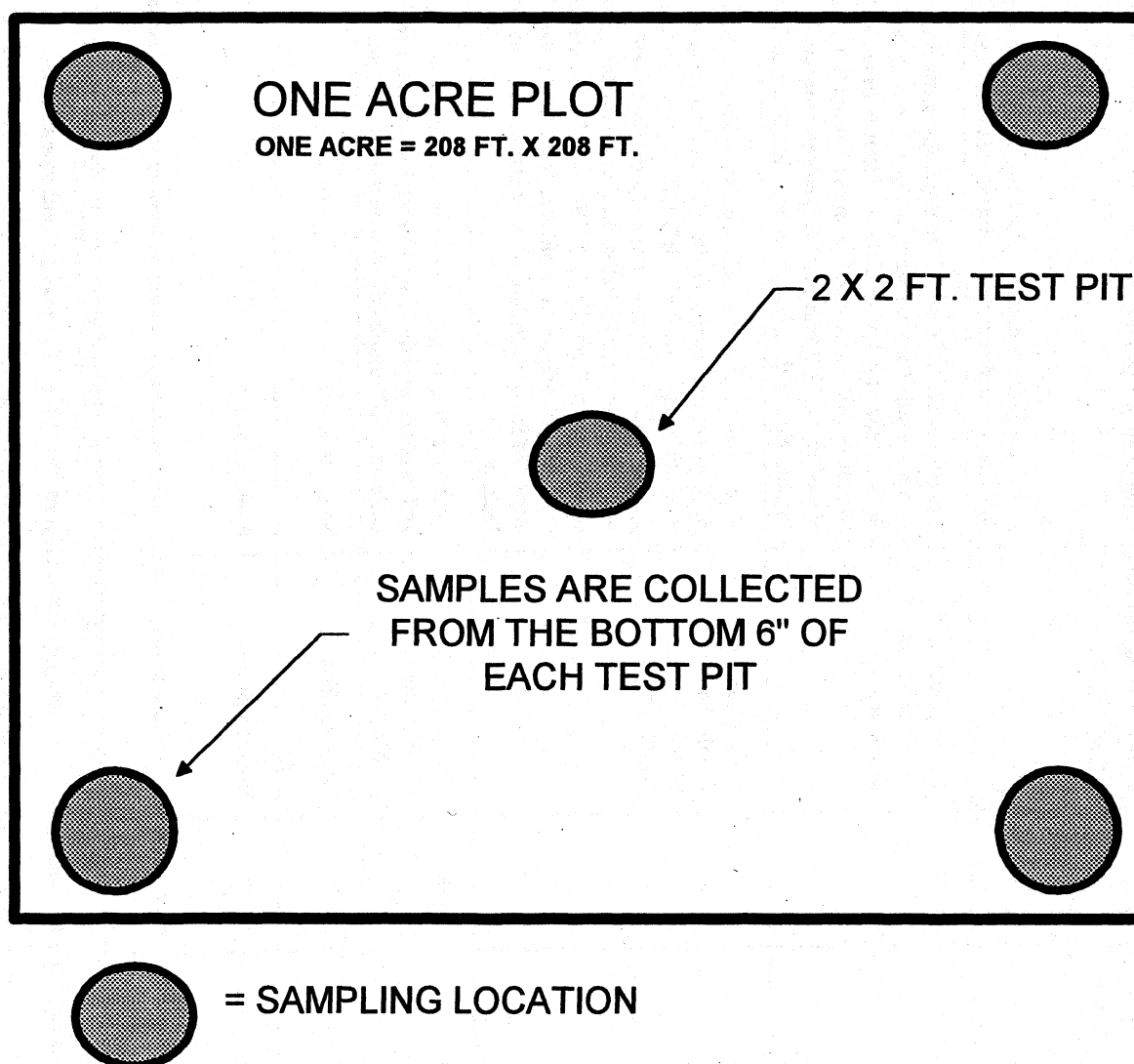
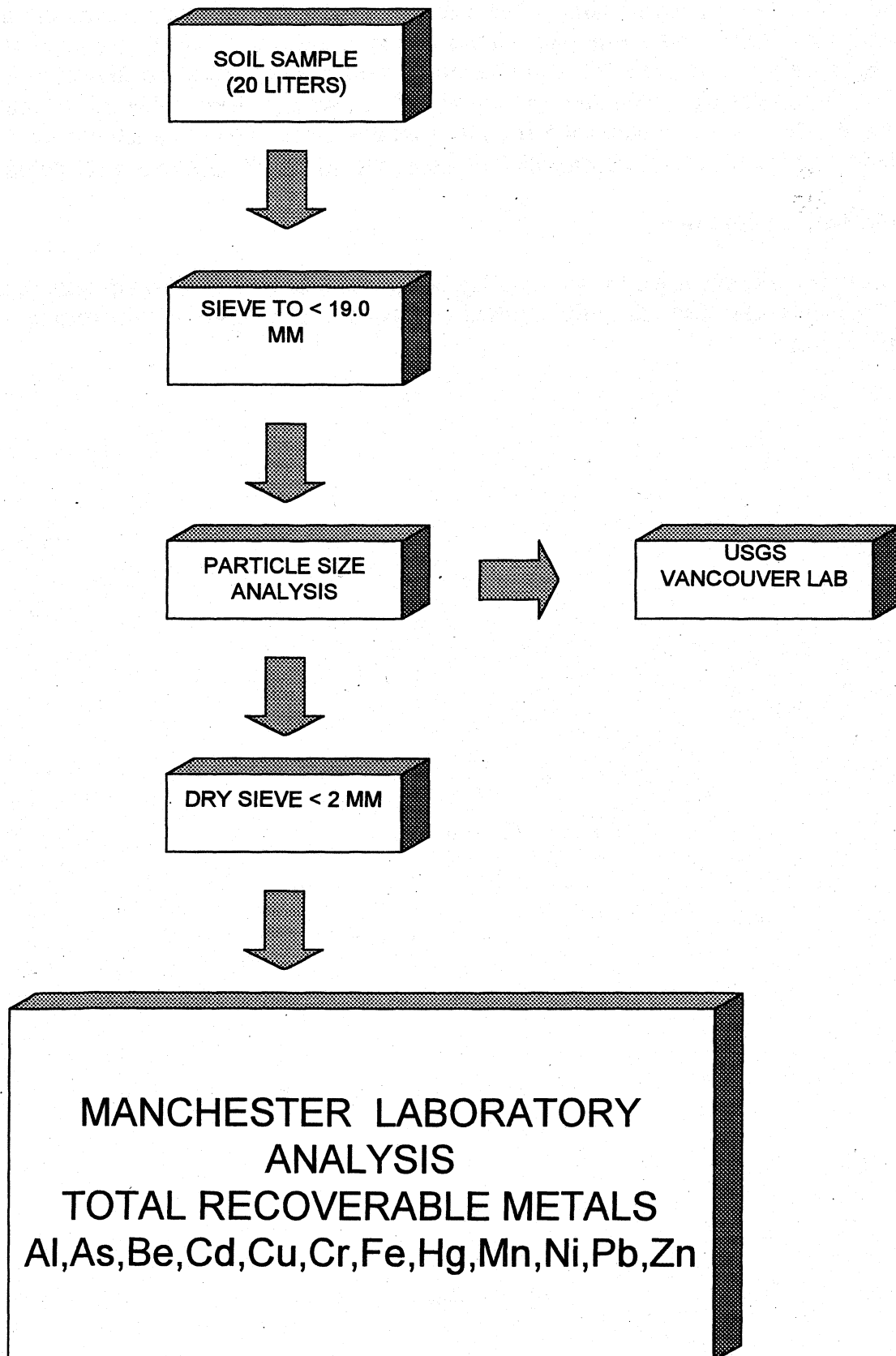


FIGURE 4: SOIL SAMPLE PREPARATION, BACKGROUND SOIL METALS PROJECT



Vertical Profile Samples

A second sampling procedure, known as "vertical profile" sampling, was also used in the statewide assessment study. Vertical profile samples were collected using the following procedure: a hand-dug hole located at the center of a 1-acre plot was completed to a depth of 5-6 ft.. Samples were then collected from the "A", "B", and "C" soil horizons. Two types of vertical profiles were used. In version "A", 5 samples were collected. In version "B", 13 samples were collected--5 from the center hand-dug hole and an additional 8 from four locations near the hole (each corner of a 1-acre plot; 2 samples per location). Samples collected from vertical profile locations were not composited.

Equipment Decontamination

Before and after collecting samples, all sampling equipment was washed with tap water and detergent (Alconox) and then sequentially rinsed with tap water, a 60/40 acetone/hexane solution, and deionized water.

V. ANALYSIS

Laboratory Analytical Procedures

All of the soil metals data presented in this report except for mercury, was generated by use of the "total recoverable" laboratory method; i.e., EPA Method 3050, Acid Digestion of Sediments, Sludges, and Soils. In this method, a representative (1-2 gram wet weight) sample is digested in nitric acid and hydrogen peroxide. The digestate is then refluxed with either nitric acid or hydrochloric acid. EPA Method 6010, Inductively Coupled Plasma Atomic Emission Spectroscopy (ICP), is then used for analysis after the samples are digested and solubilized. This method measures element-emitted light by optical spectrometry (EPA SW-846, Test Method for Evaluating Solid Waste, Volume 1A, 1986). Mercury analysis was performed by using EPA Method 7471, Manual Cold-Vapor Technique. This technique is based on the atomic absorption of radiation at the 253.7-nm wavelength by mercury vapor. Because of the ability to produce lower detection limits, atomic absorption methods were also used to analyze arsenic and selenium (EPA Methods 7060 and 7740). A summary of all laboratory analytical methods is given in Table 5.

Grain Size

All of the samples sent to Manchester Laboratory were sieved to sizes less than 2 mm prior to analysis. This practice is consistent with Ch. 173-340-740 (7) WAC of the MTCA; i.e., compliance with soil cleanup levels shall be based on total analysis of the soil fraction less than 2 mm in size.

Table 5: Laboratory Analytical Methods Summary

Parameter	Test	Laboratory Methods	Laboratory
Metals ¹	Total Recoverable Metals	Samples are prepared using Method 3050 Acid Digestion of Sludges, Sediments, and Soils. Analysis is performed using EPA 6010, Inductively Coupled Plasma Atomic Emission Spectroscopy (ICP).	Manchester
Metals ¹	Total-Total Metals	At least 95 percent of the solid material is digested using hydrochloric, nitric, hydrofluoric, and perchloric acids. Material is then solubilized and analyzed using ICP & AA techniques.	USGS Denver, Colorado (Arvada)
As	Graphite Furnace Atomic Absorption (GFAA)	EPA 7060 & 7740	Manchester
Hg	Cold Vapor	EPA 7471 Manual Cold-Vapor Technique	Manchester

¹ Al, As, Be, Cd, Cr, Cu, Fe, Mn, Ni, Pb, Zn

VI. STUDY RESULTS

Data Analysis

Since more than one sample was collected at many sampling locations, a decision was made to simply average all of the measured values per location, including sample splits and duplicates. For each of the twelve elements, one value is reported per sampling location. Thus, a sample population of 166 was used for the calculation of natural background values (166 sampling locations). One-half the detection limit value was also used for non-detect values, per MTCA specifications (Ch 173-340-708 (11)(e) WAC).

Calculation of Background Values

Ecology's MTCASat program (MTCASat is a software package developed for use with Microsoft Excel to meet the need for a fast, simple, integrated method of performing routine statistical analyses described in the statistical *Guidance for Ecology Site Managers*) was used to calculate 90th percentile values for 12 elements (Al, As, Be, Cd, Cr, Fe, Hg, Mg, Mn, Ni, Pb, Zn). The 90th percentile value is used by Ecology to calculate natural background values. Statewide and area or regional natural background values were calculated for Clark County, Puget Sound, Yakima, and Spokane. Statewide 90th percentile values are given in Table 6 and Figure 5.

What is the 90th Percentile Value?

The 90th percentile is a value that 10% of a given data set will exceed (90th = 90% data below, 10% data above). Another way of thinking about the 90th percentile is you have a one-in-ten chance of having a sample that exceeds the specified concentration.

Why is this important?

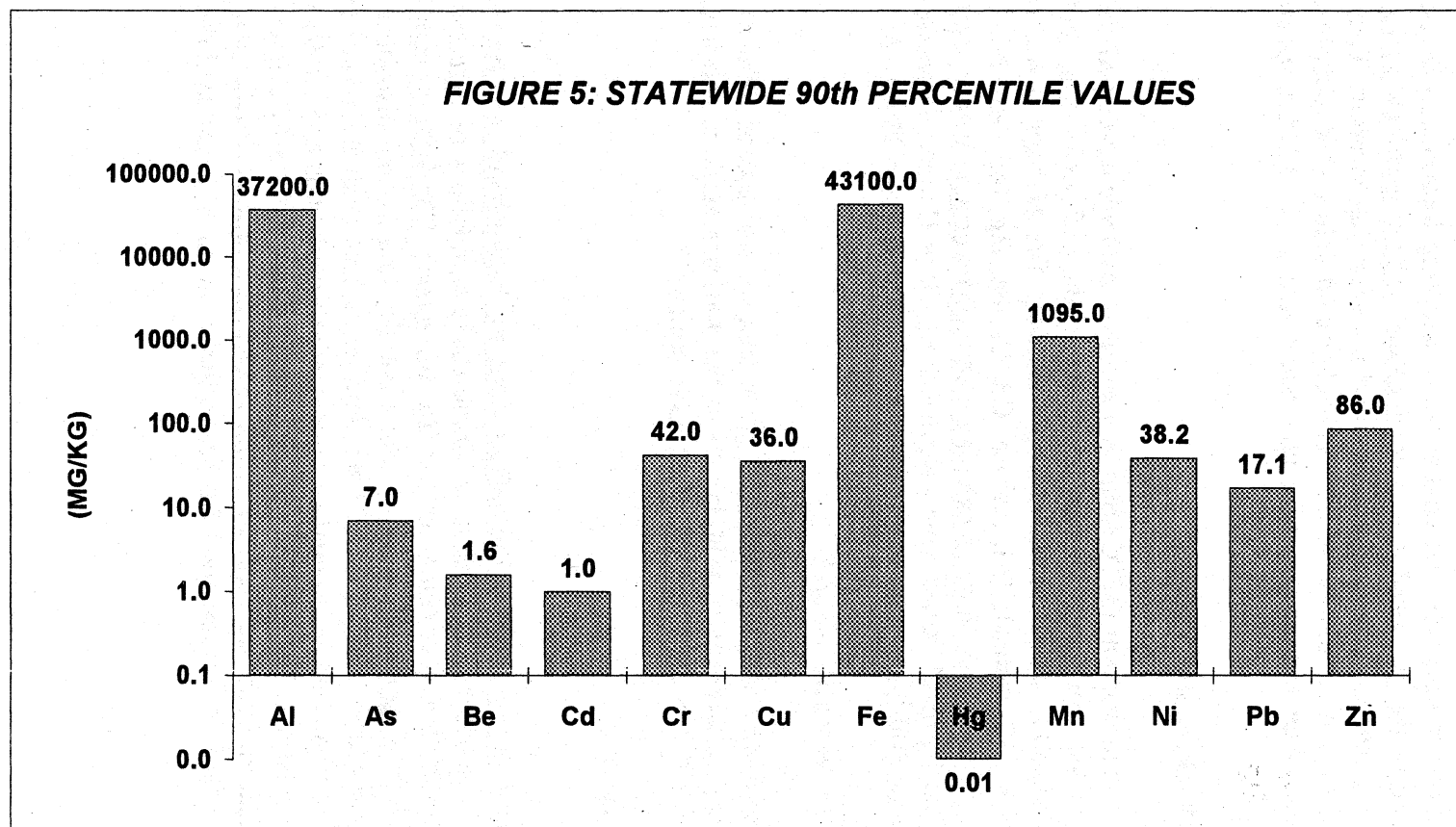
Ecology uses the 90th percentile as the default value for background calculations. The 90th percentile value was selected as a result of Monte Carlo simulations of lognormal and normally distributed data (ref: *Statistical Guidance for Site Managers*). The 90th percentile is a conservative value; i.e., 10% of the data will exceed it. For example, in a normal distribution or bell-shaped curve, the 90th percentile is equal to 1.28 standard deviations from the mean. In the same distribution, the 95th percentile is equal to 1.96 standard deviations and the 99th percentile is equal to 3.0 standard deviations. Background values in some states such as Michigan, and in Ontario (Canada) are based on 99th and 98th percentile values (in a normal distribution, the 99th percentile = mean + 3 standard deviations, the 97.5 percentile = mean + 2 standard deviations).

TABLE 6: STATEWIDE 90th PERCENTILE VALUES

SAMPLE POPULATION (n) = 166

Al	As	Be	Cd	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Zn
37200.0	7.0	1.6	1.0	42.0	36.0	43100.0	0.01	1095.0	38.2	17.1	86.0

All Values = mg/kg



Note: See Figure 47 for Ag, Ba, Ca, Co, Mg, Na, Sb, Se, Ti, & V 90th Percentile Values

90th Percentile Comparison

A summary comparison of 90th percentile values is given in Table 7. The sample population for each regional group is given in Table 7 and Figure 6. When comparing 90th percentile values between data sets, the following observations were made:

- ▶ Five of the 13 maximum 90th percentile values came from one data set, Group "W" (Al, Cr, Cu, Hg, Ni). This occurrence is probably due to the smaller sample population (15) of Group "W" (note: Group "W" is comprised of Regions "A", "C", and "D" and encompasses that area outside of the Puget Sound Basin and Clark County regions),
- ▶ Conversely, seven of the minimum 90th percentile values came from one data set, Spokane Basin (Al, Cr, Cu, Fe, Hg, Ni, Zn). Additionally, when compared against other data sets, the Spokane data tended to have the least amount of variation from maximum to minimum values.
- ▶ The west-side 90th percentile values are on average 1.5 times higher than the east-side values (see Table 8 and Figures 7-9). The lone exception to this was the east-side 90th percentile value for arsenic, which was 15% higher than the west-side value. The extremities in climate, vegetation, and geology between Western and Eastern Washington are thought to be the primary reasons for variations in the west/east 90th percentile values.

Background Values: Washington and Other States

A comparison of Washington's 90th percentile values to those from other states or other background studies is presented in Table 9 and Figure 10. This comparison found that the background values identified in Washington are very similar to those detected in other states or other studies.

TABLE 7: COMPARISON OF 90th PERCENTILE VALUES

	n	Al	As AA	As ICP	Be	Cd	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Zn
GROUP "W"	15	62,905	8.47	N/A	0.75	0.10	78.46	52.85	49,170	0.13	691.75	54.19	10.87	85.56
PUGET SOUND	45	32,581	7.30	22.80	0.61	0.77	48.15	36.36	36,128	0.07	1,146.00	38.19	16.83	85.06
CLARK COUNTY	26	52,276	5.81	60.80	2.07	0.93	26.57	34.43	58,665	0.04	1,511.00	21.04	24.02	95.52
WEST (ALL)	86	45,735	6.37	46.21	1.51	1.20	47.40	43.23	50,125	0.08	1,337.27	44.20	20.42	98.39
STATEWIDE	166	37,206	6.99	41.81	1.44	0.99	41.88	36.01	43,106	0.07	1,094.85	38.19	17.09	85.82
EAST (ALL)	80	28,299	7.61	36.17	1.27	0.81	31.88	28.40	36,644	0.04	836.00	24.54	13.10	80.91
YAKIMA BASIN	32	33,379	5.13	41.79	1.57	0.93	38.27	26.47	51,451	0.05	1,104.84	45.89	11.00	78.71
SPOKANE BASIN	27	21,376	9.34	20.83	0.84	0.72	17.81	21.61	25,026	0.02	663.48	16.19	14.91	66.40
GROUP "E"	21	25,591	5.76	N/A	0.61	N/A	37.80	28.42	29,631	0.02	526.59	22.41	9.85	67.47

ALL VALUES = MG/KG

FIGURE 6: SAMPLE POPULATIONS (n)

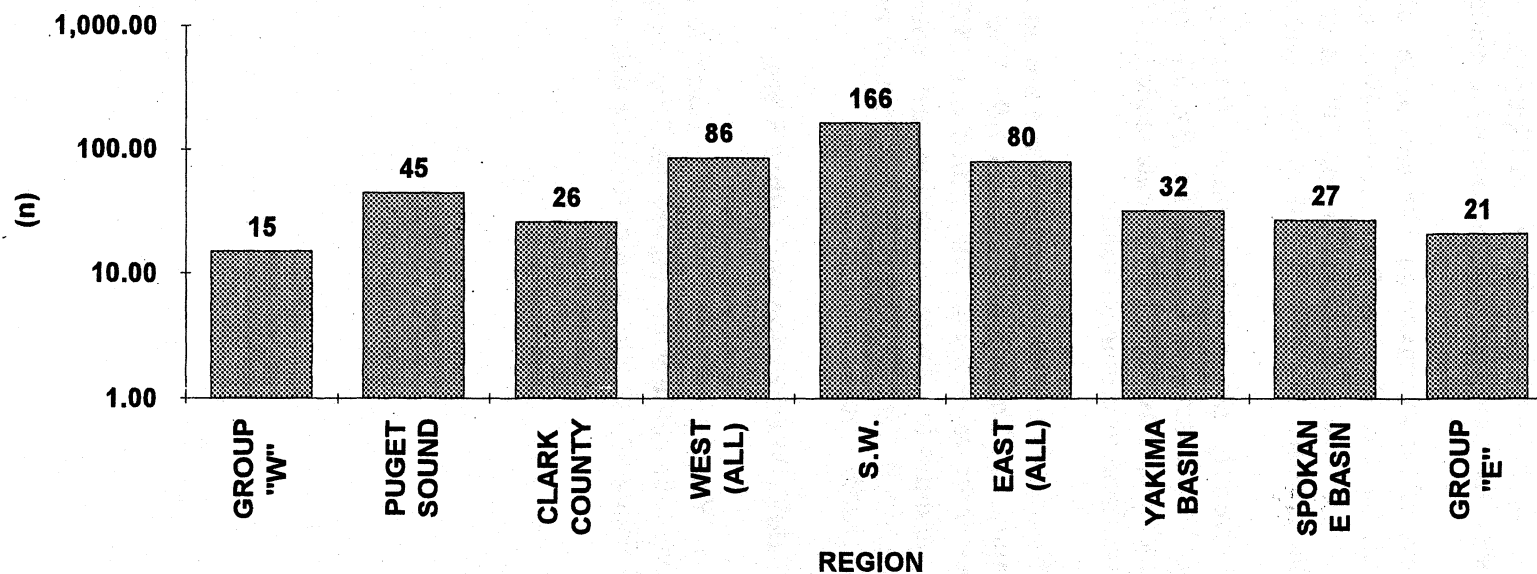


TABLE 8: COMPARISON OF WEST/EAST 90th PERCENTILE VALUES

	Al	As	Be	Cd	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Zn
WEST (ALL)	45,735.00	6.37	1.51	1.20	47.40	43.23	50,125.00	0.08	1,337.27	44.20	20.42	98.39
EAST (ALL)	28,299.00	7.31	1.27	0.81	31.88	28.40	36,644.00	0.04	836.00	24.54	13.10	80.91
RATIO W:E	1.62		1.19	1.48	1.49	1.52	1.37	2.00	1.60	1.80	1.56	1.22
MEAN RATIO	1.53											

ALL VALUES = MG/KG

FIGURE 7: Al, Fe COMPARISON

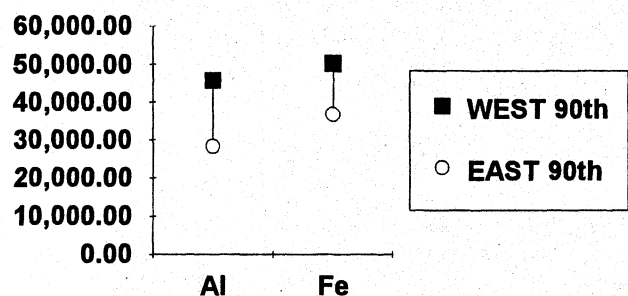


FIGURE 8: Be, Cd, Hg COMPARISON

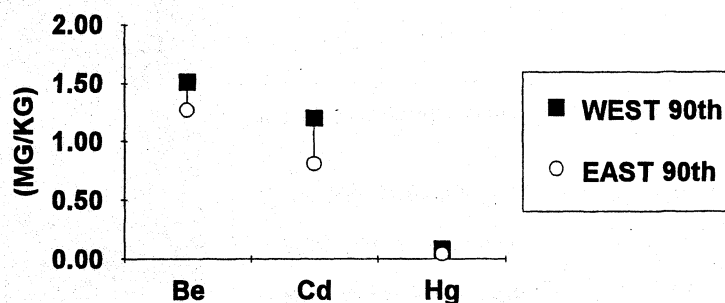
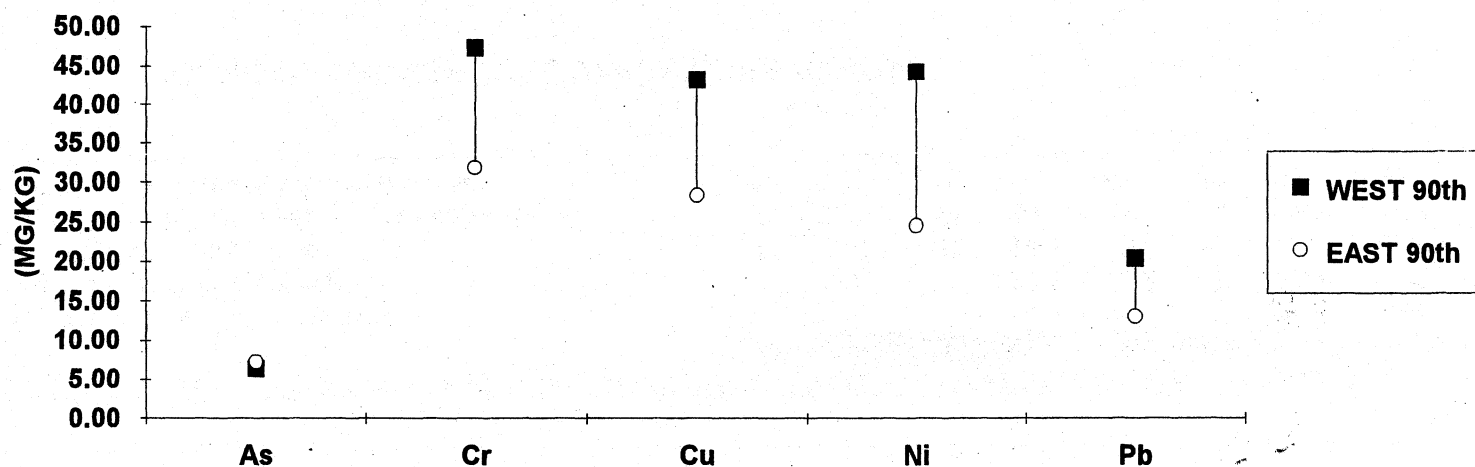


FIGURE 9: As, Cr, Cu, Ni, Pb COMPARISON

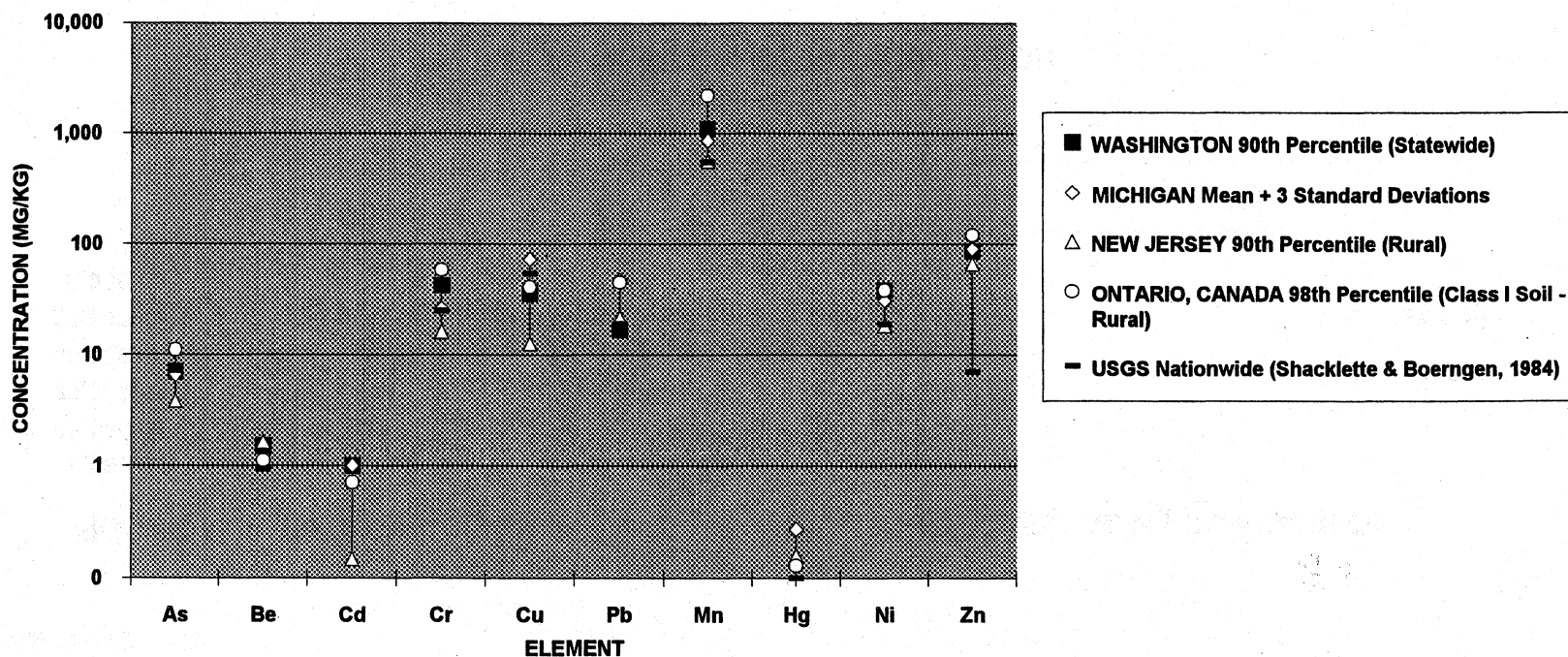


*NA = VALUE NOT AVAILABLE

TABLE 9: COMPARISON OF WASHINGTON BACKGROUND VALUES TO OTHER STATES (MG/KG)

	As	Be	Cd	Cr	Cu	Pb	Mn	Hg	Ni	Zn
WASHINGTON 90th Percentile (Statewide)	7	1.5	1	41.8	36	17	1095	0.07	38.2	85.8
MICHIGAN Mean + 3 Standard Deviations	7	*NA	1	26.2	72.2	47	855.8	0.27	30.9	90.3
NEW JERSEY 90th Percentile (Rural)	4	1.63	0.15	16.5	12.8	22	561	0.16	18.7	65.9
ONTARIO, CANADA 98th Percentile (Class I Soil - Rural)	11	1.1	0.71	58	41	45	2,200	0.13	38	120
USGS Nationwide (Shacklette & Boerngen, 1984)	7	0.92	*NA	25	54	19	550	0.1	19	7

FIGURE 10: BACKGROUND VALUE COMPARISON



VII. ANALYSIS OF REGIONAL VARIATION

Overview

Due to time, budget, and resources, a highly sophisticated statistical analysis of the variation in data between regions was not performed. Routine comparative methods were instead employed to analyze the data. Due to the significant variation in climate, soils, geology, vegetation, population, etc. throughout Washington, the decision was made to simply compare the following values from each data set: (a) 90th percentile; (b) maximum and minimum; and (c) median (see Figures 11-22). A brief discussion on the observations made per element is also included in this section.

Data Sets

For comparison purposes, the data were subdivided into nine basic groups (see Table 10 below). Sampling data from Puget Sound, Yakima Basin, Clark County, and Spokane Basin comprise four groups. Three additional groups were created by pooling data into west, east, and statewide groups. The Cascade Mountain Range was used as a dividing line for the west/east data groups. Group "W" contains that data independent of the Puget Sound and Clark County data sets. Group "E" contains that data independent of the Yakima and Spokane Basins data sets.

Table 10: Data Subdivisions

Data Group	Sample Population	Definition
Group "W"	15	Whatcom and Skagit Counties, Pacific Coast (Grays Harbor, Lewis, and Pacific Counties).
Puget Sound	45	Snohomish, King, Pierce, Thurston, Mason, Jefferson, Island, San Juan, and Clallam Counties.
Clark County	26	Clark County
West (All)	86	All sampling locations west of the Cascade Mountain Range
Statewide	166	All statewide sampling locations
East (All)	80	All sampling locations east of the Cascade Mountain Range
Yakima Basin	32	Yakima, Kittitas, Chelan, and Grant Counties
Spokane Basin	27	Spokane, Lincoln, and Pend Oreille Counties
Group "E"	21	Benton, Spokane, Lincoln, Adams, Okanogan, and Whitman Counties

Aluminum

A notable west-east trend was observed in the aluminum data set (see **Figure 24**). Both the 90th percentile and lognormal mean values for west-side are nearly twice as high as the east side data (see **Table 11** below). The reason for this is unknown; however, it is suspected that the wet west-side climate is probably a significant factor (i.e., the formation of bauxite). Higher aluminum concentrations (greater than 40,000 mg/kg) were detected in Whatcom County (Mt. Baker), along the Pacific Coast (Pacific County) and the Clark County Vancouver area. Significantly lower aluminum values (less than 20,000 mg/kg) were detected in the Spokane Basin (see **Figure 11**).

Table 11: Aluminum 90th Percentile and Lognormal Mean Values - West and East Data

Value	West (n = 86)	East (n = 80)
90th Percentile	45,700	28,300
Lognormal Mean	25,500	18,200

All Values = mg/kg n = sample population

Arsenic

The statewide distribution of arsenic in soil was remarkably uniform throughout the state (between 1 - 10 mg/kg, see **Figures 12 and 26**). Specifically, there was very little variation in the median and 90th percentile values for each data set (see **Figure 9**). One possible reason for nominal variation in the arsenic data set is the use of atomic absorption analytical methods, which is considered to be more reliable for arsenic at lower concentrations (as opposed to ICP methods). Arsenic was the only element whose 90th percentile value was higher in Eastern Washington. Higher arsenic values (greater than 50 mg/kg) were detected in the Tacoma vicinity (Pt. Defiance Park)--probably due to fallout from the Asarco Smelter. Higher values were also detected in the Yakima Basin, which may be due to the extensive use of arsenic-based pesticides.

Beryllium

The variation in the statewide distribution of beryllium was somewhat unusual. Specifically, higher values (greater than 1 mg/kg) were observed only in the Vancouver area and Central Washington (Yakima and Ellensburg). The Clark County beryllium data are also unique in that the data are normally distributed and the 90th percentile value, 2.1 mg/kg, was notably higher than all other data sets (see **Figure 13**).

Cadmium

The statewide distribution of cadmium was relatively uniform, with approximately 40% (61 out of 165 values) of the data set at or below detection limits (less than 0.2 or 0.8 mg/kg, see **Figures 14 and 30**).

Chromium

A significant west-east variation was noted in the chromium data set. An examination of the statewide chromium concentration map (see **Figure 32**) finds that the west-side values are notably higher than the east. Higher chromium values were detected in the Mt. Baker area (Region "D;" Northern Skagit and Whatcom Counties). The reason for the detection of higher chromium values in this area is not known. However, the difference between west to east 90th percentile values (47.4 vs. 31.9 mg/kg) is not considered to be important from a cleanup perspective since the MTCA Method A soil cleanup level for chromium, 100 mg/kg, is over twice the statewide or area background values.

Copper

A slight west-east trend was observed in the copper data set. Specifically, there is a noticeable lack of higher values (greater than 40 mg/kg) in the Spokane Basin region. However, there is a fairly constant distribution (10-100 mg/kg) in copper from Yakima to Seattle (see **Figure 33**).

Iron

Very little variation was observed in the iron data set. Examination of the X,Y scatter plot (see **Figure 35**) reveals a straight-line set of values between 1,000 and 100,000 mg/kg. However, there was some variation in the iron data for Clark County, as noted by the detection of the maximum 90th percentile value (58,700 mg/kg) in this region.

Lead

The lead data set is unique in that it appears to mimic statewide population trends; i.e., higher values were detected in more densely populated regions (Seattle, Vancouver, Yakima, and Spokane, see **Figure 38**). Higher lead values in more densely populated areas may be due to fallout from automobile exhaust. However, an examination of the X,Y scatter plot finds that nearly all the lead values tended to fall between 2 and 20 mg/kg (see **Figure 37**).

Manganese

The variation in the manganese data set was relatively nominal with nearly all values falling between 100 and 1,000 mg/kg. The one exception was the Clark County data set, which was normally distributed with a median value of 510 mg/kg (max value observed, see **Figure 19**). Higher manganese concentrations (greater than 1,000 mg/kg) were observed in the Vancouver, Yakima, and the Seattle-Tacoma-Olympia corridor.

Nickel

A noticeable west-east trend was observed in the nickel data set. Values greater than 20 mg/kg were not detected east of Yakima (see **Figure 44**).

Zinc

Very little variation was observed in the statewide zinc data set. Nearly all the values fell between 10 and 100 mg/kg (see **Figures 45 & 46**).

Other Elements

Background data were also compiled for ten other elements: antimony (Sb), barium (Ba), calcium (Ca), cobalt (Co), magnesium (Mg), sodium (Na), selenium (Se), titanium (Ti), thallium (Tl), and vanadium (V). The Ba, Ca, Co, Mg, Na, Ti, and V data were collected only in the Spokane Basin area, and the data for Ag, Sb, Se is limited since these elements were normally not detected above laboratory detection limits. Because of these two factors, an assessment of the regional variation for these elements was not completed. A brief summary of the 90th percentile values for these elements is given in **Figure 47**.

Antimony

Approximately 10% of the data set (50 samples) exceed laboratory detection limits (ICP analysis @ 3 mg/kg). Based on this data, a 90th percentile value of 5 mg/kg was calculated for Sb.

Selenium

The ICP data for selenium were not assessed because the standard detection limits used were too high (5 - 15 mg/kg). Only 14 selenium samples exceeded atomic absorption (AA) analytical detection limits. Of these 14, only two were given a laboratory code of "J," which means that the analyte was positively identified. The remaining 12 were assigned a laboratory code of "P," which means that the analyte was detected above the instrument detection limit but below the established minimum quantitation limit. Based on those samples exceeding AA detection limits, a 90th percentile value of 0.78 mg/kg was estimated for selenium.

Silver

Less than 10% of the data set (33 samples) exceeded laboratory detection limits (0.3 mg/kg). Based on this data, a 90th percentile value of 0.61 mg/kg was calculated.

Thallium

Values above the laboratory detection limit (5 mg/kg) were not detected.

Why are the West-Side Background Values Higher?

The formation of soils is to a large degree a weathering phenomenon that is heavily influenced by climate and vegetation. Thus, the wet climate and dense vegetation of Western Washington has undoubtedly been a significant factor in the formation of west-side soils. Conversely, the much

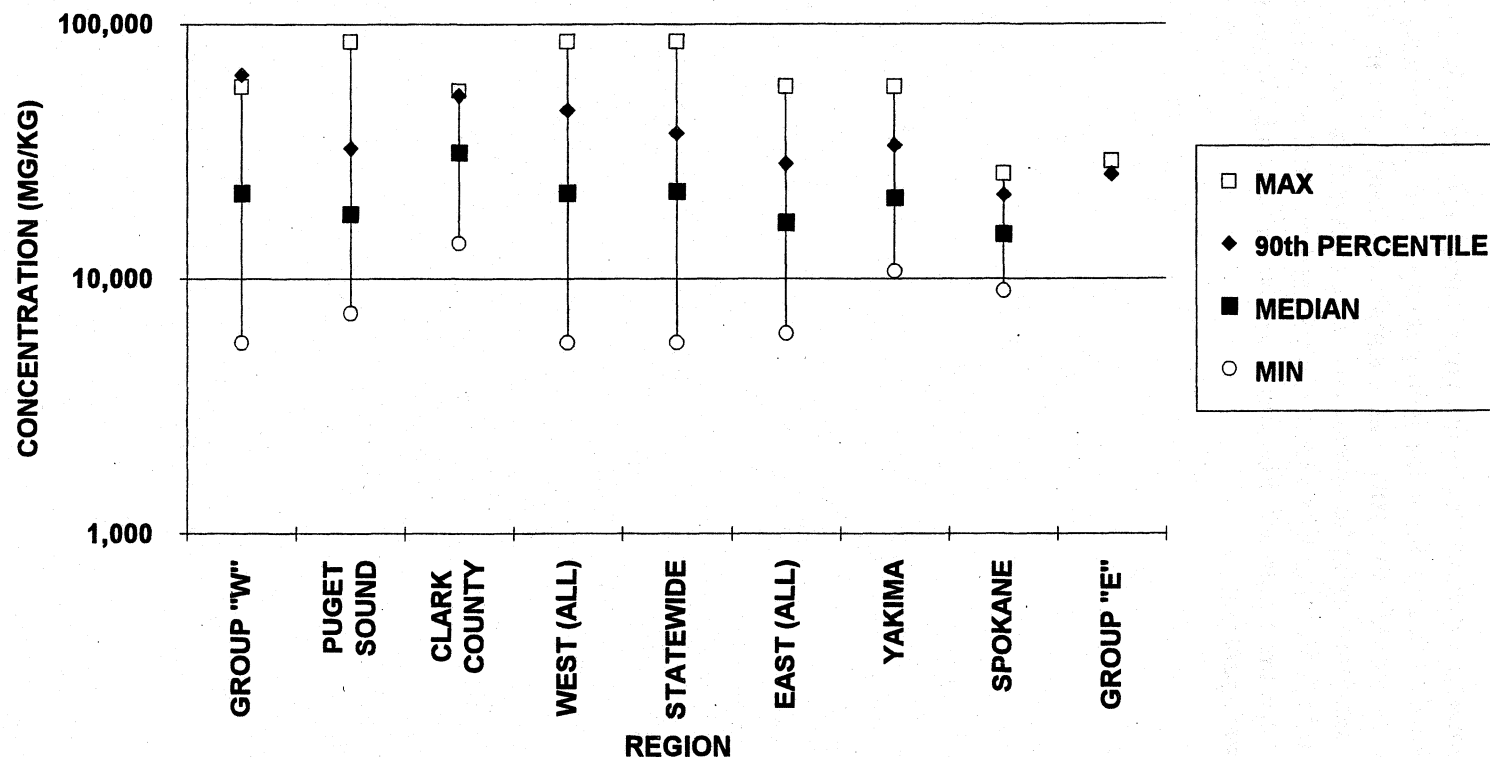
dryer climate and sparser vegetative pattern in Eastern Washington has likely produced a different type of soil.

Geologic Diversity

The actual effect of Washington's diverse geologic makeup upon this study is thought to be somewhat nominal. Specifically, nearly all of the data points for the 12 elements fall within one order of magnitude. Thus, if geologic diversity was a significant issue, then the argument could conceivably be made that the data should be spread out across several orders of magnitude.

However, it should also be kept in mind that this study focused on surficial soils only. Thus, it may not be appropriate to compare the results of this study against the potential impact of geologic diversity upon the entire soil spectrum.

FIGURE 11: ALUMINUM REGIONAL ANALYSIS

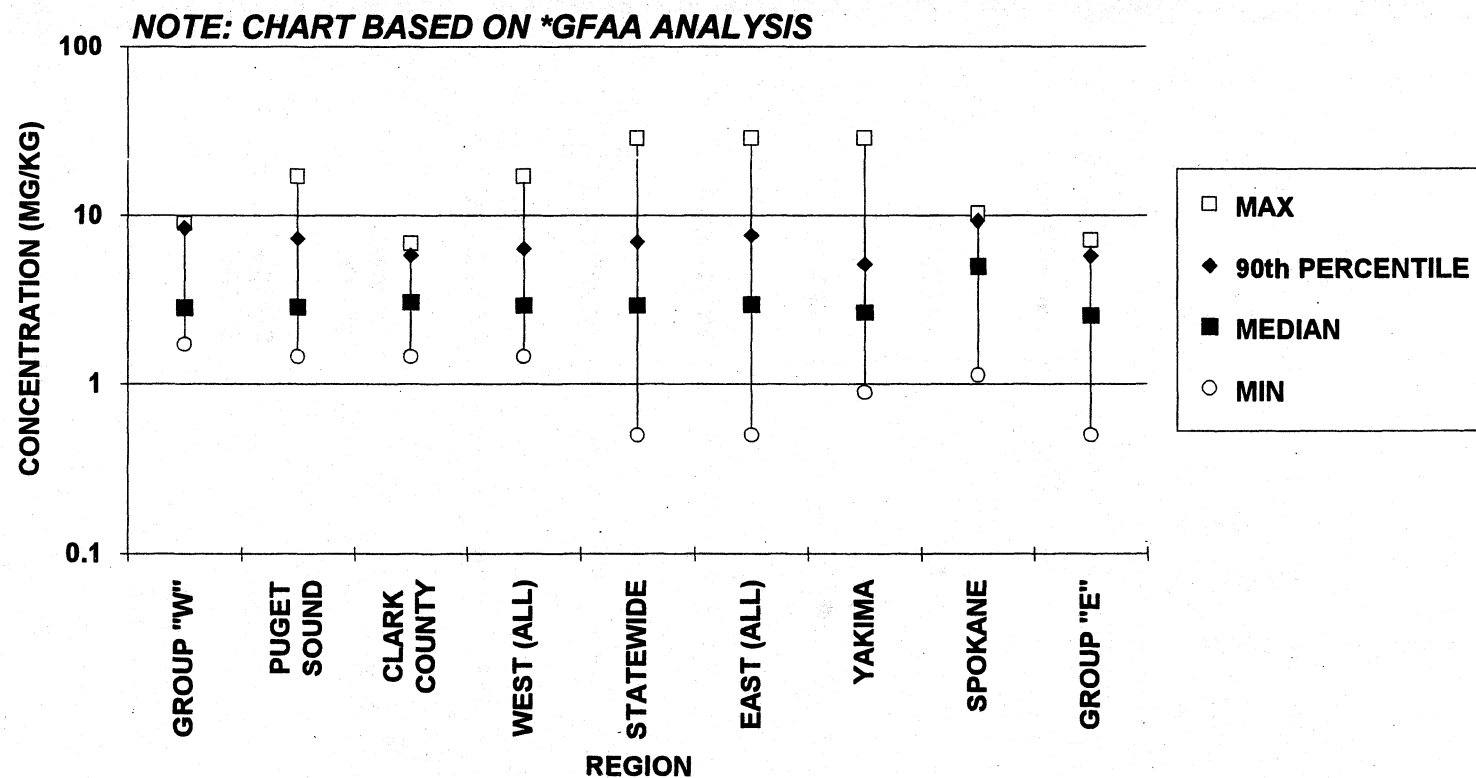


ALL VALUES = MG/KG	GROUP "W"	PUGET SOUND	CLARK COUNTY	WEST (ALL)	STATEWIDE	EAST (ALL)	YAKIMA	SPOKANE	GROUP "E"
MAX	56,550	84,900	54,550	84,900	84,900	56,550	56,550	25,850	29,000
90th PERCENTILE	62,905	32,581	52,276	45,735	37,206	28,299	33,379	21,376	25,591
MEDIAN	21,700	17,900	31,192	21,760	21,956	16,600	20,800	15,000	14,800
MIN	5,670	7,390	13,750	5,670	5,670	6,140	10,650	8,933	6,140

NOTE: GROUP "W" = WHATCOM, SKAGIT, GRAYS HARBOR, LEWIS, AND PACIFIC COUNTIES

GROUP "E" = BENTON, SPOKANE, LINCOLN, ADAMS, OKANOGAN, AND WHITMAN COUNTIES

FIGURE 12: ARSENIC REGIONAL ANALYSIS

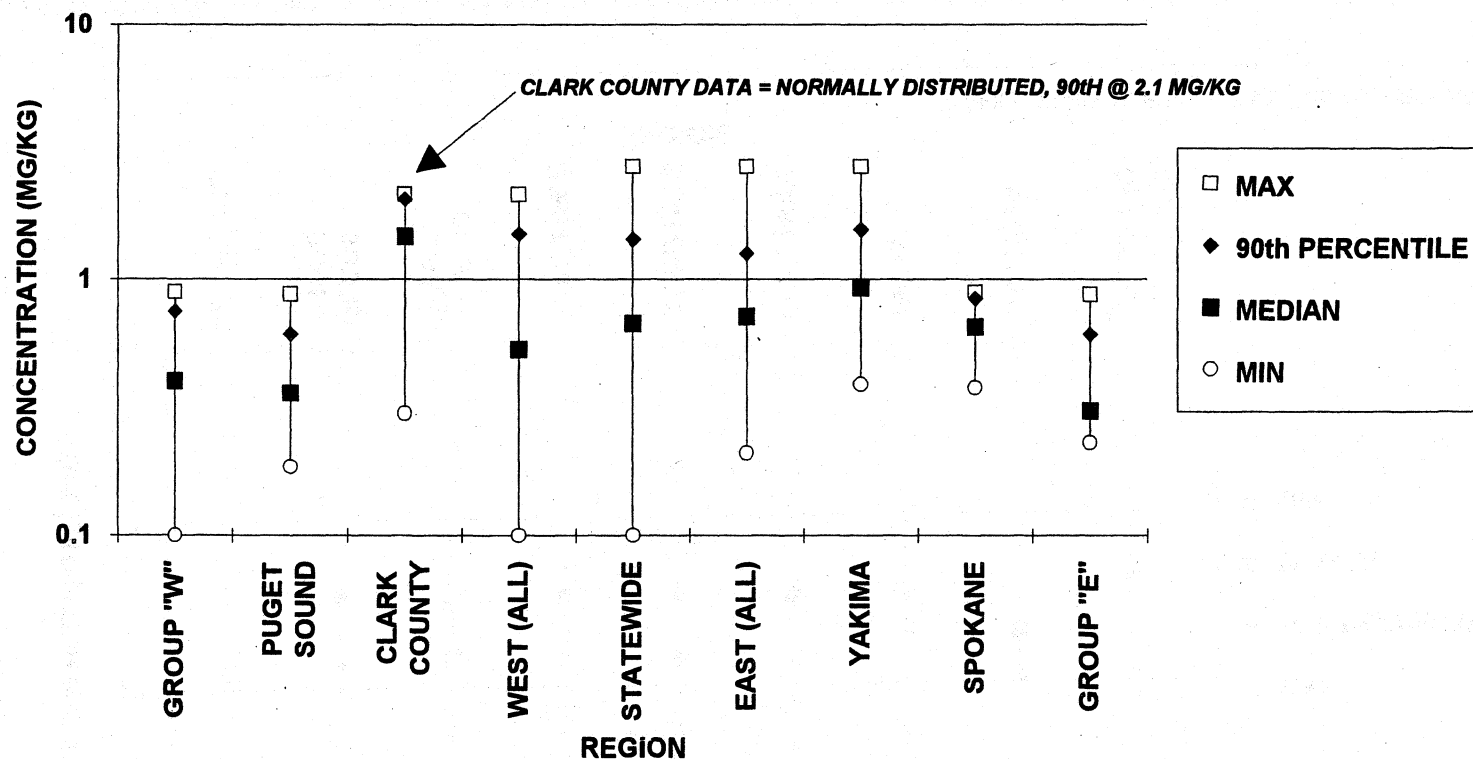


*GFAA = GRAPHITE FURNACE ATOMIC ABSORPTION

ALL VALUES = MG/KG	GROUP "W"	PUGET SOUND	CLARK COUNTY	WEST (ALL)	STATEWIDE	EAST (ALL)	YAKIMA	SPOKANE	GROUP "E"
MAX	8.99	17.17	6.89	17.168	28.6	28.6	28.6	10.32	7.19
90th PERCENTILE	6.47	7.30	5.81	6.37	6.99	7.61	5.13	9.34	5.76
MEDIAN	2.8	2.86	3.045	2.91	2.92	2.95	2.64	4.99	2.53
MIN	1.7	1.45	1.45	1.45	0.5	0.5	0.89	1.13	0.5

NOTE: GROUP "W" = WHATCOM, SKAGIT, GRAYS HARBOR, LEWIS, AND PACIFIC COUNTIES
 GROUP "E" = BENTON, SPOKANE, LINCOLN, ADAMS, OKANOGAN, AND WHITMAN COUNTIES

FIGURE 13: BERYLLIUM REGIONAL ANALYSIS

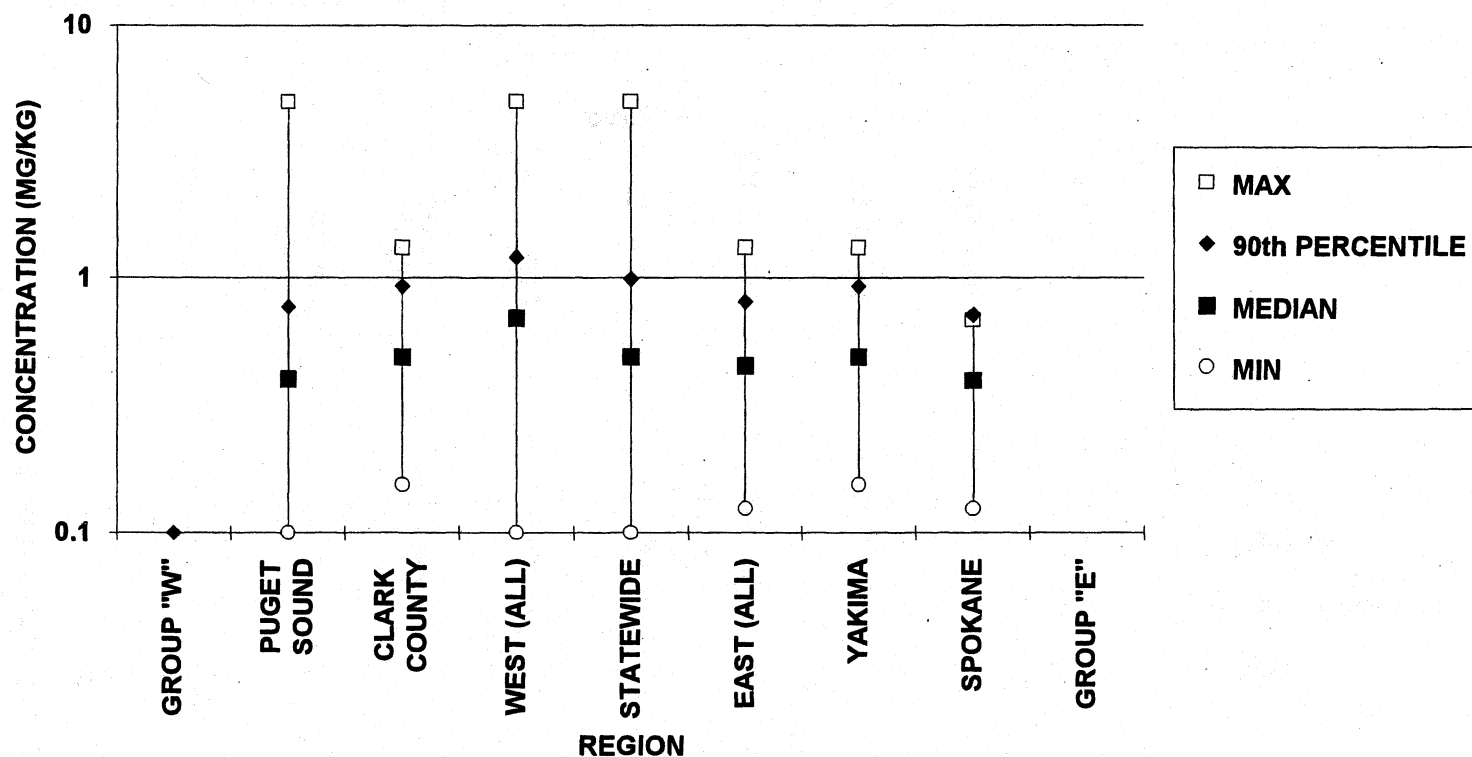


ALL VALUES = MG/KG	GROUP "W"	PUGET SOUND	CLARK COUNTY	WEST (ALL)	STATEWIDE	EAST (ALL)	YAKIMA	SPOKANE	GROUP "E"
MAX	0.89	0.875	2.155	2.155	2.79	2.79	2.79	0.89	0.875
90th PERCENTILE	0.75	0.61	2.07	1.51	1.44	1.27	1.57	0.64	0.61
MEDIAN	0.4	0.358	1.479	0.53	0.67	0.72	0.93	0.655	0.305
MIN	0.1	0.185	0.3	0.1	0.1	0.21	0.39	0.37775	0.23

NOTE: GROUP "W" = WHATCOM, SKAGIT, GRAYS HARBOR, LEWIS, AND PACIFIC COUNTIES

GROUP "E" = BENTON, SPOKANE, LINCOLN, ADAMS, OKANOGAN, AND WHITMAN COUNTIES

FIGURE 14: CADMIUM REGIONAL ANALYSIS

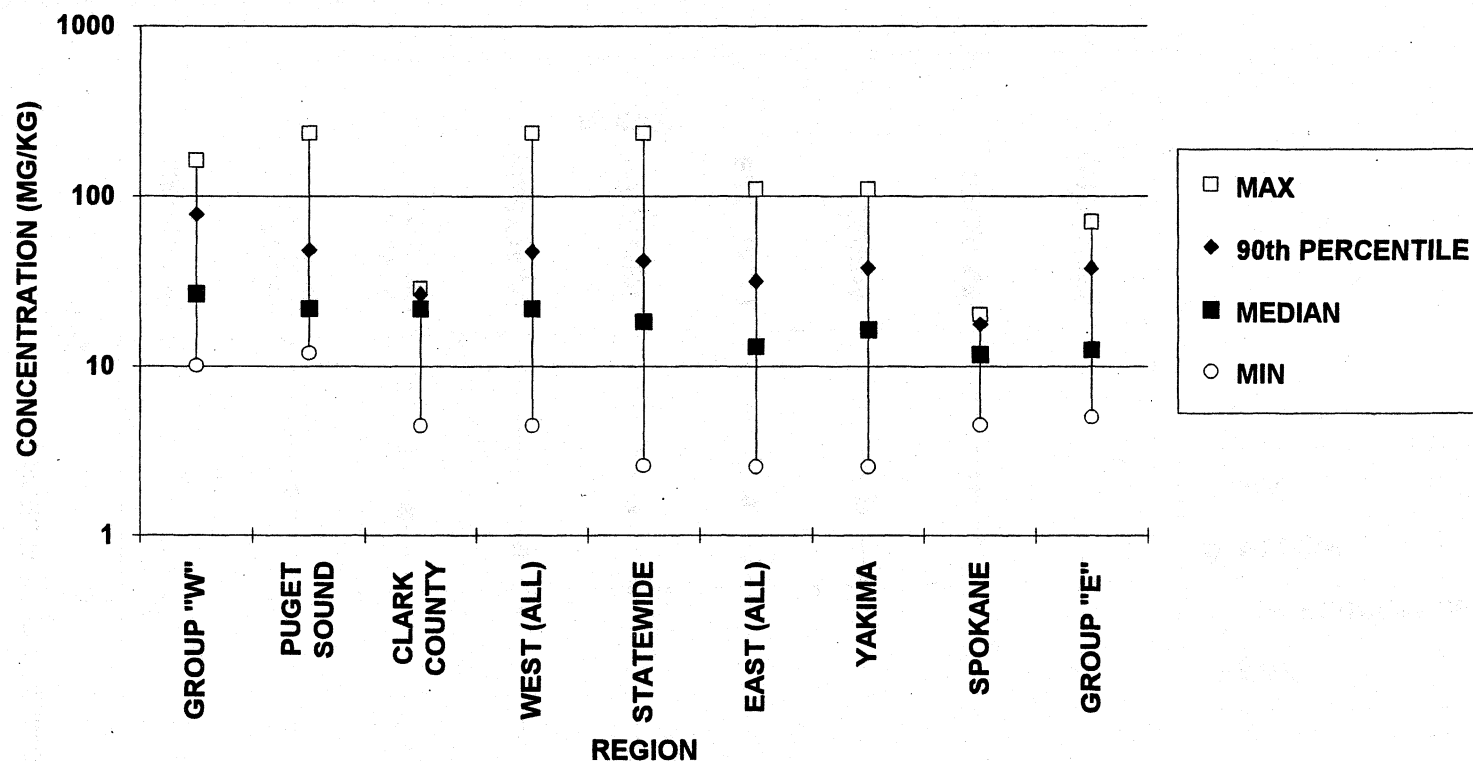


ALL VALUES = MG/KG	GROUP "W"	PUGET SOUND	CLARK COUNTY	WEST (ALL)	STATEWIDE	EAST (ALL)	YAKIMA	SPOKANE	GROUP "E"
MAX	N/A	5	1.32	5	5	1.32	1.32	0.685	N/A
90th PERCENTILE	0.1	0.77	0.93	1.2	0.99	0.81	0.93	0.72	N/A
MEDIAN	N/A	0.4	0.49	0.7	0.49	0.45	0.49	0.395	N/A
MIN	N/A	0.1	0.155	0.1	0.1	0.125	0.155	0.125	N/A

NOTE: GROUP "W" = WHATCOM, SKAGIT, GRAYS HARBOR, LEWIS, AND PACIFIC COUNTIES

GROUP "E" = BENTON, SPOKANE, LINCOLN, ADAMS, OKANOGAN, AND WHITMAN COUNTIES

FIGURE 15: CHROMIUM REGIONAL ANALYSIS

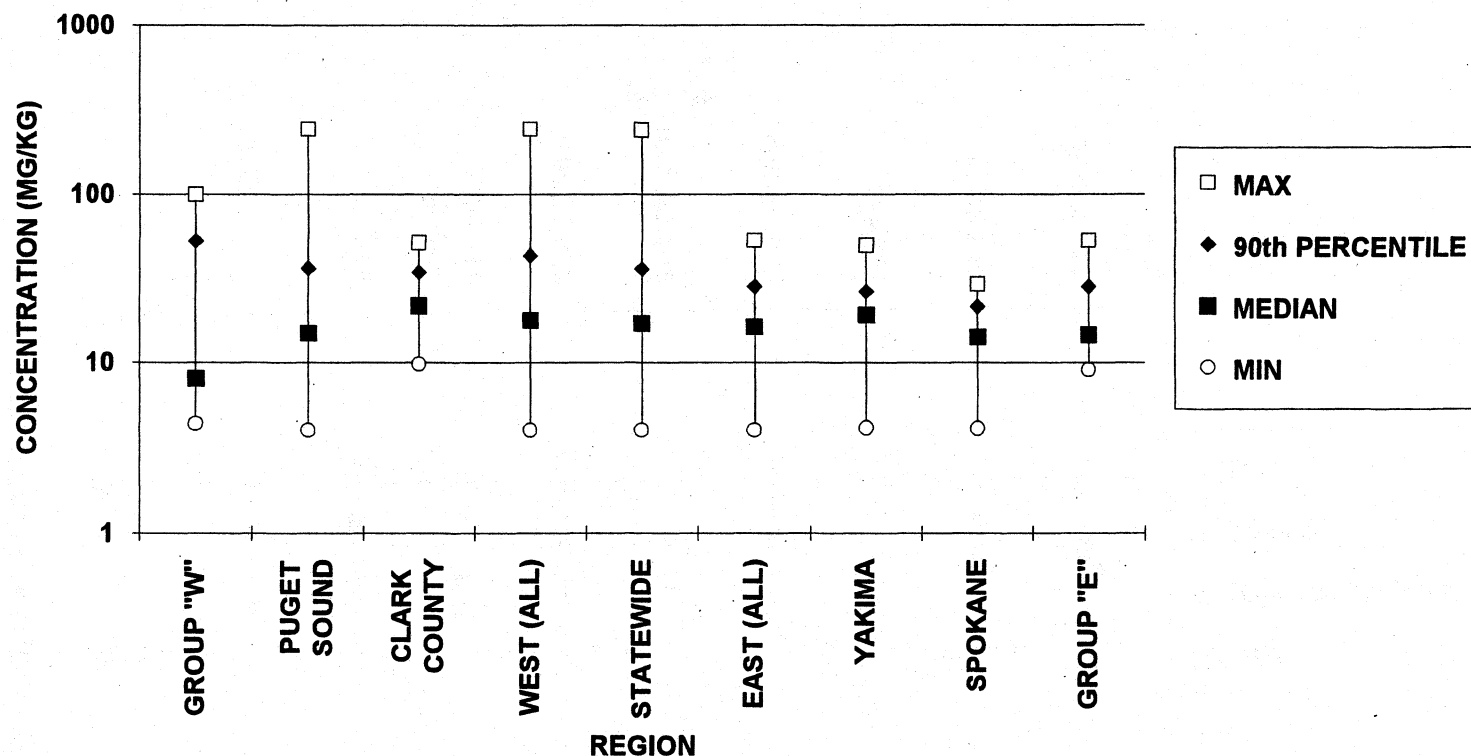


ALL VALUES = MG/KG	GROUP "W"	PUGET SOUND	CLARK COUNTY	WEST (ALL)	STATEWIDE	EAST (ALL)	YAKIMA	SPOKANE	GROUP "E"
MAX	163	235	28.83	235	235	110.3	110.3	20.25	71.3
90th PERCENTILE	78.46	48.15	26.57	47.4	41.88	31.88	38.27	17.81	37.8
MEDIAN	26.7	22	21.99	22	18.42	13.15	16.42	11.78	12.6
MIN	10.1	12	4.42	4.42	2.56	2.55	2.55	4.5	5

NOTE: GROUP "W" = WHATCOM, SKAGIT, GRAYS HARBOR, LEWIS, AND PACIFIC COUNTIES

GROUP "E" = BENTON, SPOKANE, LINCOLN, ADAMS, OKANOGAN, AND WHITMAN COUNTIES

FIGURE 16: COPPER REGIONAL ANALYSIS

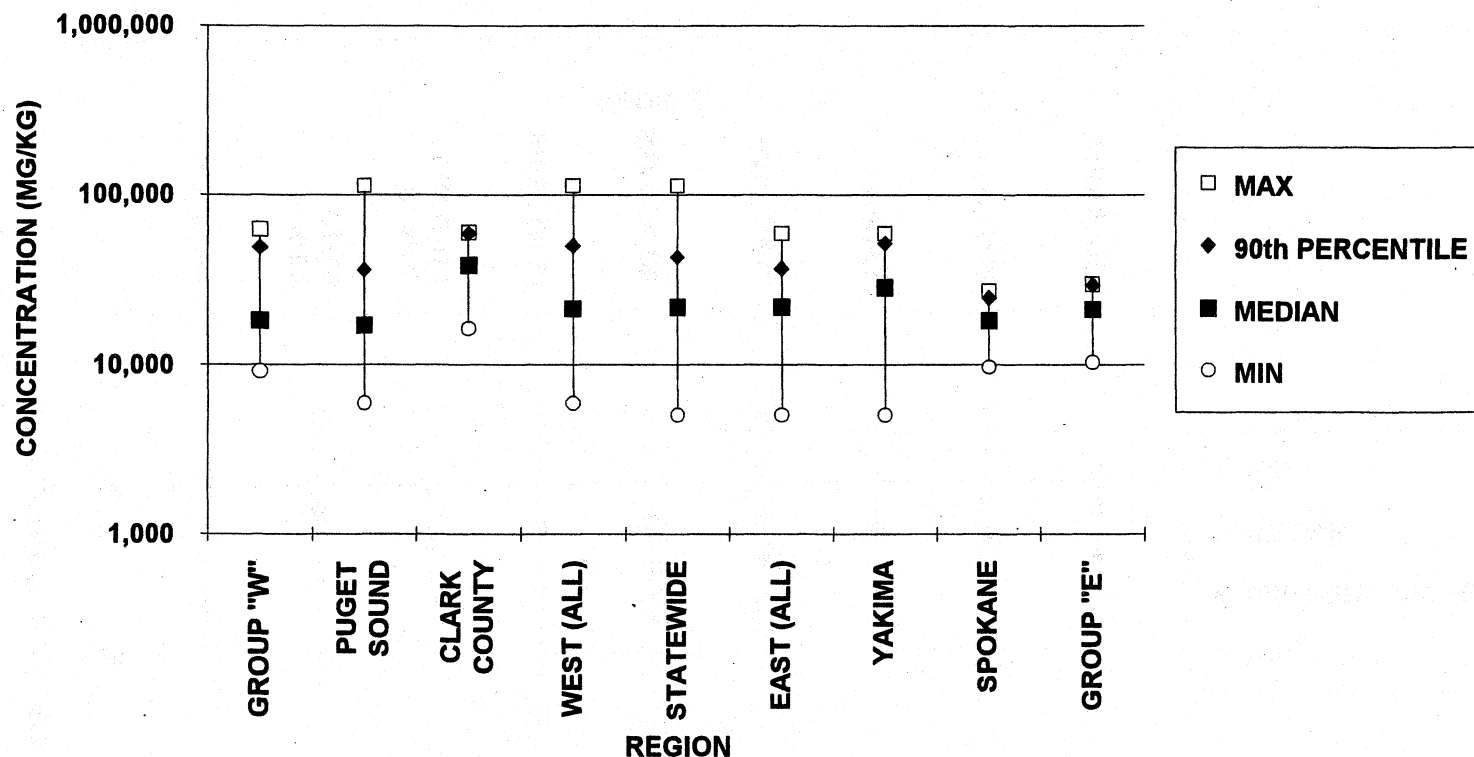


ALL VALUES - MG/KG	GROUP "W"	PUGET SOUND	CLARK COUNTY	WEST (ALL)	STATEWIDE	EAST (ALL)	YAKIMA	SPOKANE	GROUP "E"
MAX	99.4	243.5	51.71	243.5	243	53	50.15	29.03	53
90th PERCENTILE	52.85	36.36	34.43	43.23	36.01	28.4	26.47	21.61	28.42
MEDIAN	8.05	15	21.78	17.8	17.07	16.3	19.225	14.14	14.7
MIN	4.33	4	9.71	4	4	4	4.125	4.04	9.1

NOTE: GROUP "W" = WHATCOM, SKAGIT, GRAYS HARBOR, LEWIS, AND PACIFIC COUNTIES

GROUP "E" = BENTON, SPOKANE, LINCOLN, ADAMS, OKANOGAN, AND WHITMAN COUNTIES

FIGURE 17: IRON REGIONAL ANALYSIS

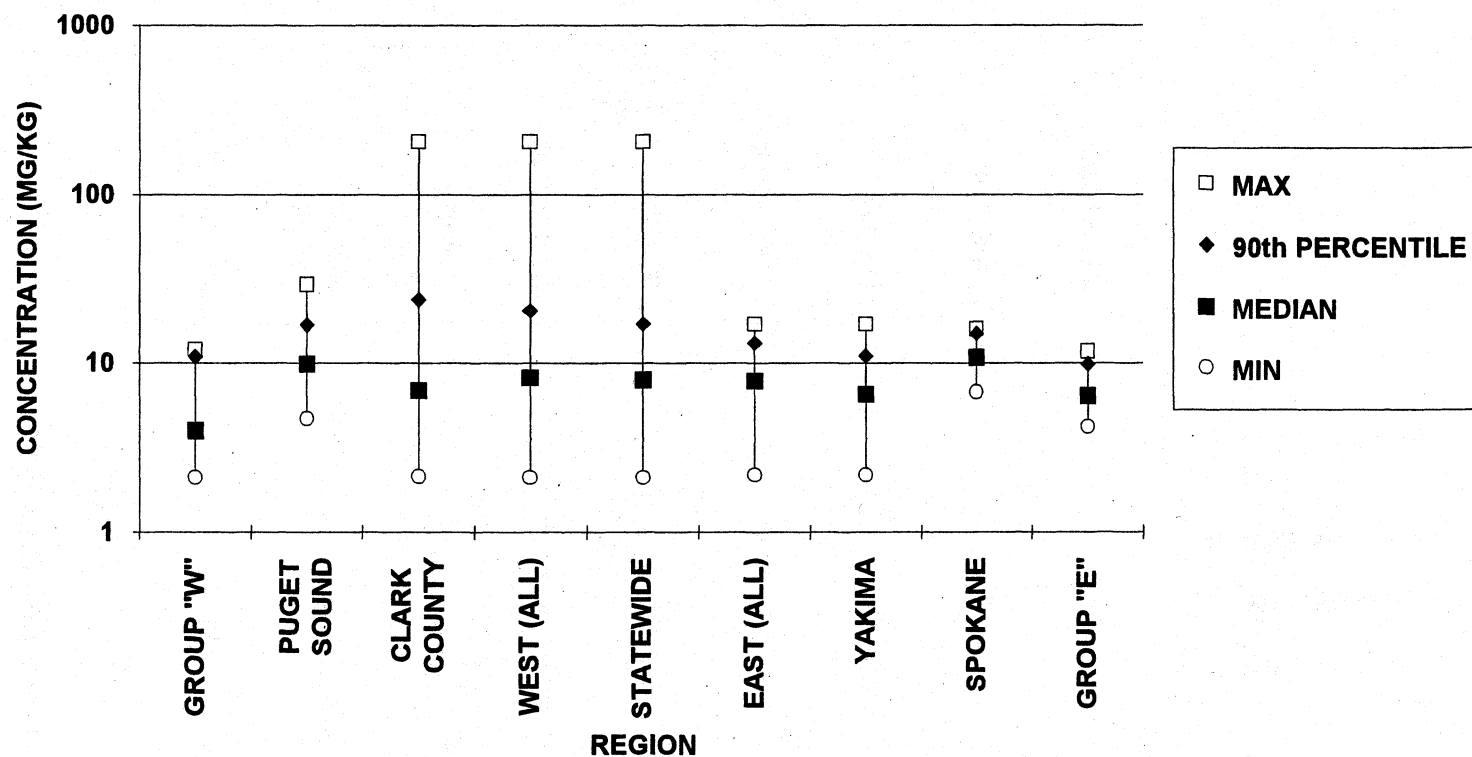


ALL VALUES = MG/KG	GROUP "W"	PUGET SOUND	CLARK COUNTY	WEST (ALL)	STATEWIDE	EAST (ALL)	YAKIMA	SPOKANE	GROUP "E"
MAX	62,800	112,500	59,850	112,500	112,500	58,800	58,880	27,000	30,000
90th PERCENTILE	49,170	36,125	59,665	50,125	43,106	36,644	51,451	25,026	29,631
MEDIAN	18,200	17,050	38,508	21,433	22,033	22,116	28,821	18,150	21,300
MIN	9,160	5,920	16,350	5,920	5,025	5,025	5,025	9,670	10,400

NOTE: GROUP "W" = WHATCOM, SKAGIT, GRAYS HARBOR, LEWIS, AND PACIFIC COUNTIES

GROUP "E" = BENTON, SPOKANE, LINCOLN, ADAMS, OKANOGAN, AND WHITMAN COUNTIES

FIGURE 18: LEAD REGIONAL ANALYSIS

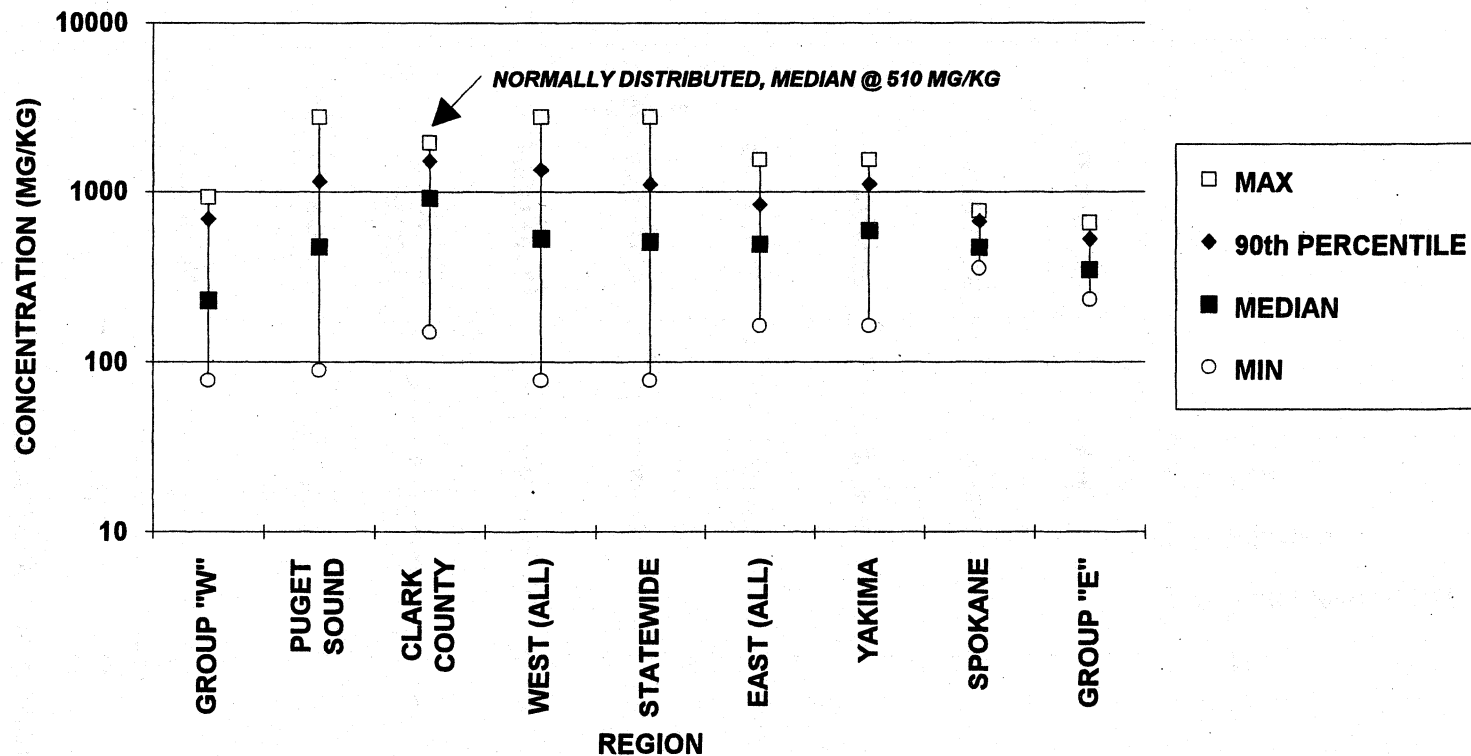


ALL VALUES = MG/KG	GROUP "W"	PUGET SOUND	CLARK COUNTY	WEST (ALL)	STATEWIDE	EAST (ALL)	YAKIMA	SPOKANE	GROUP "E"
MAX	12	29.6	207.5	207.5	207.5	17.1	17.1	16	11.7
90th PERCENTILE	10.87	16.83	24.02	20.42	17.09	13.1	11	14.91	9.85
MEDIAN	4	9.8	6.86	8.2	7.9	7.82	6.525	10.8	6.4
MIN	2.1	4.65	2.125	2.1	2.1	2.17	2.17	6.75	4.2

NOTE: GROUP "W" = WHATCOM, SKAGIT, GRAYS HARBOR, LEWIS, AND PACIFIC COUNTIES

GROUP "E" = BENTON, SPOKANE, LINCOLN, ADAMS, OKANOGAN, AND WHITMAN COUNTIES

FIGURE 19: MANGANESE REGIONAL ANALYSIS

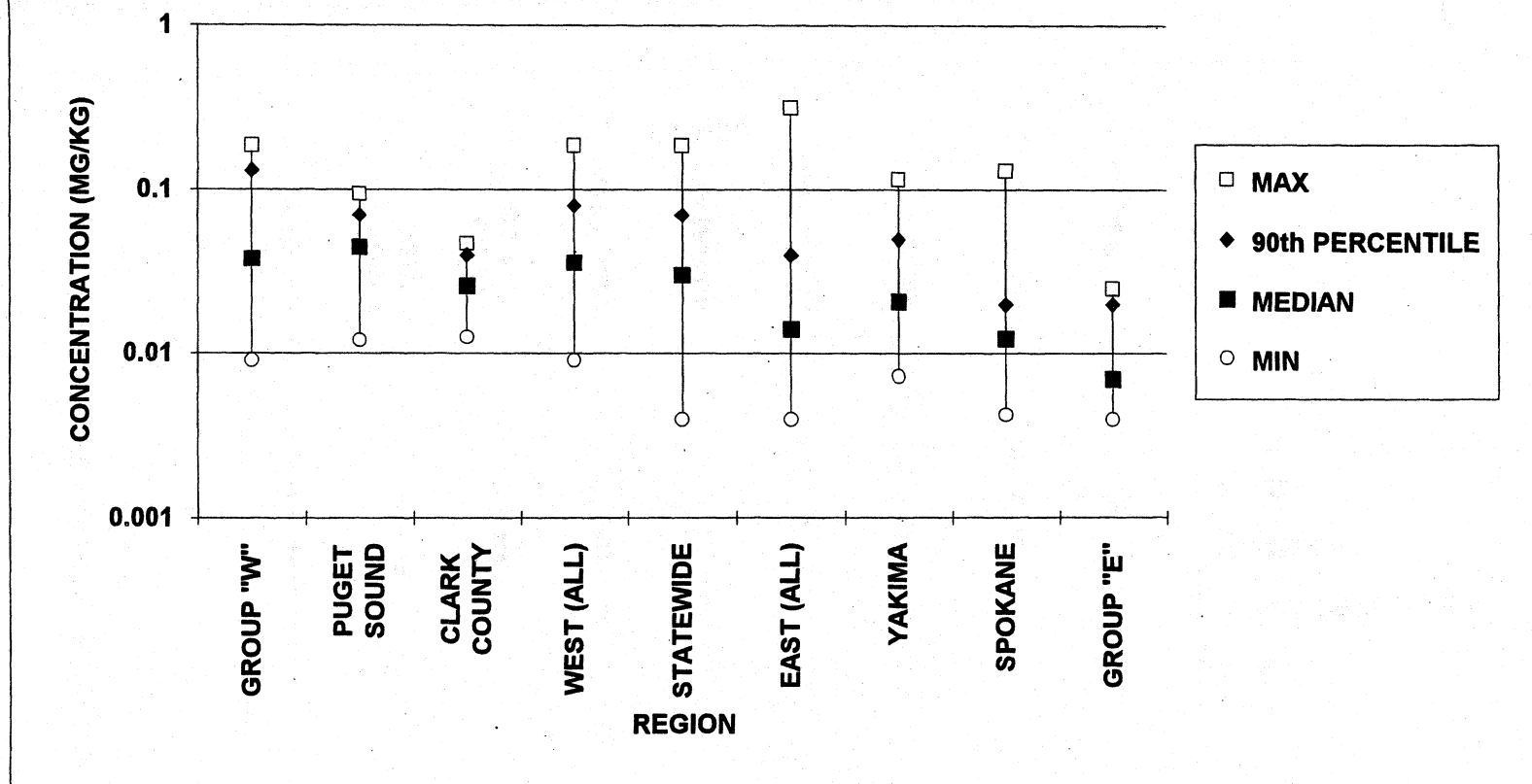


ALL VALUES = MG/KG	GROUP "W"	PUGET SOUND	CLARK COUNTY	WEST (ALL)	STATEWIDE	EAST (ALL)	YAKIMA	SPOKANE	GROUP "E"
MAX	930	2750	1960	2750	2750	1546.12	1546	769.5	652
90th PERCENTILE	691.75	1146	1511	1337.27	1094.85	836	1104.84	663.48	526.59
MEDIAN	231	474	915.5	531.25	509.58	490.75	589	470	345
MIN	78	90	150	78	78	164.45	164.45	354.5	233

NOTE: GROUP "W" = WHATCOM, SKAGIT, GRAYS HARBOR, LEWIS, AND PACIFIC COUNTIES

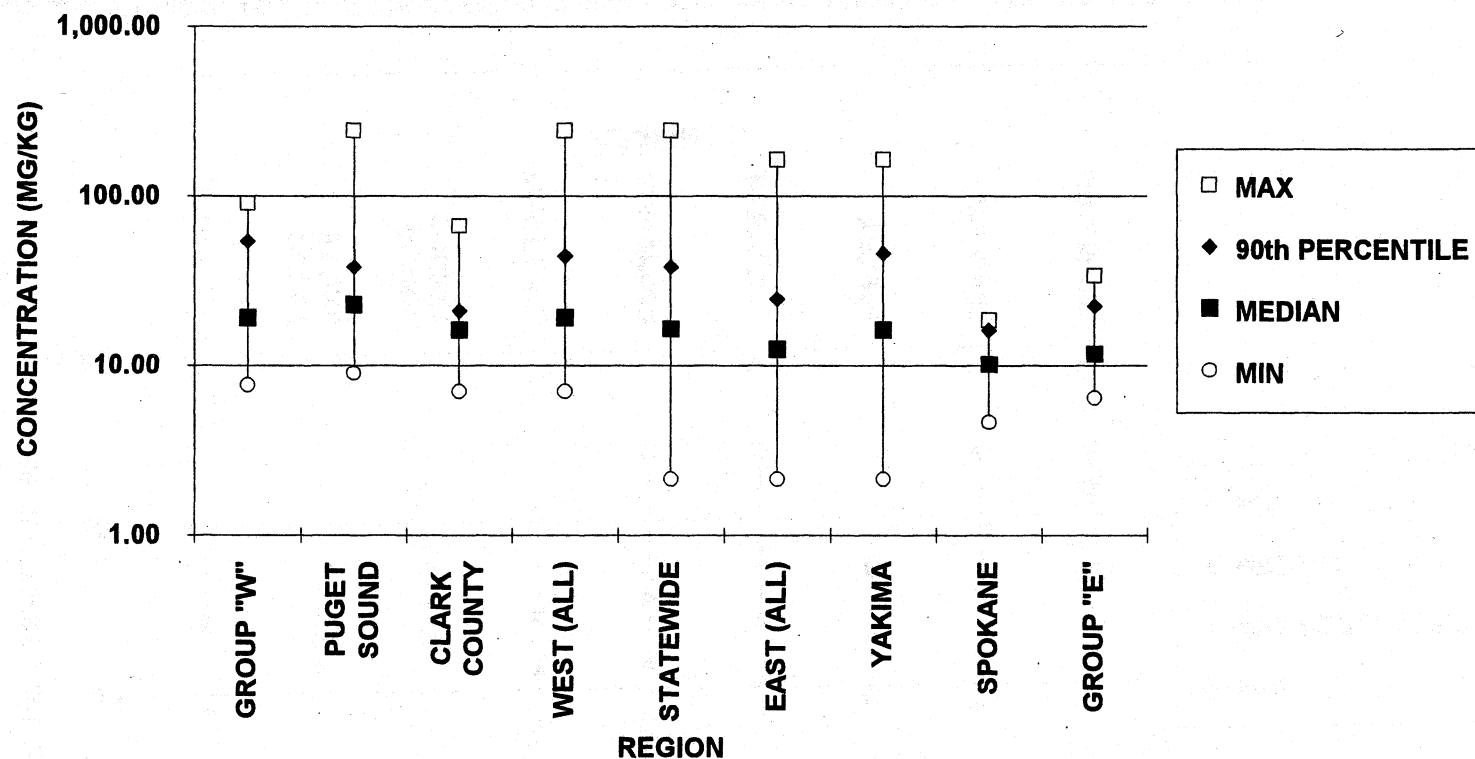
GROUP "E" = BENTON, SPOKANE, LINCOLN, ADAMS, OKANOGAN, AND WHITMAN COUNTIES

FIGURE 20: MERCURY REGIONAL ANALYSIS



ALL VALUES = MG/KG	GROUP "W"	PUGET SOUND	CLARK COUNTY	WEST (ALL)	STATEWIDE	EAST (ALL)	YAKIMA	SPOKANE	GROUP "E"
MAX	0.185	0.0944	0.047	0.185	0.185	0.312	0.1165	0.1312	0.025
90th PERCENTILE	0.13	0.07	0.04	0.08	0.07	0.04	0.05	0.02	0.02
MEDIAN	0.038	0.04475	0.026	0.0358	0.03	0.014	0.02075	0.01225	0.007
MIN	0.009	0.012	0.0125	0.009	0.004	0.004	0.00725	0.00425	0.004
NOTE: GROUP "W" = WHATCOM, SKAGIT, GRAYS HARBOR, LEWIS, AND PACIFIC COUNTIES									
GROUP "E" = BENTON, SPOKANE, LINCOLN, ADAMS, OKANOGAN, AND WHITMAN COUNTIES									

FIGURE 21: NICKEL REGIONAL ANALYSIS

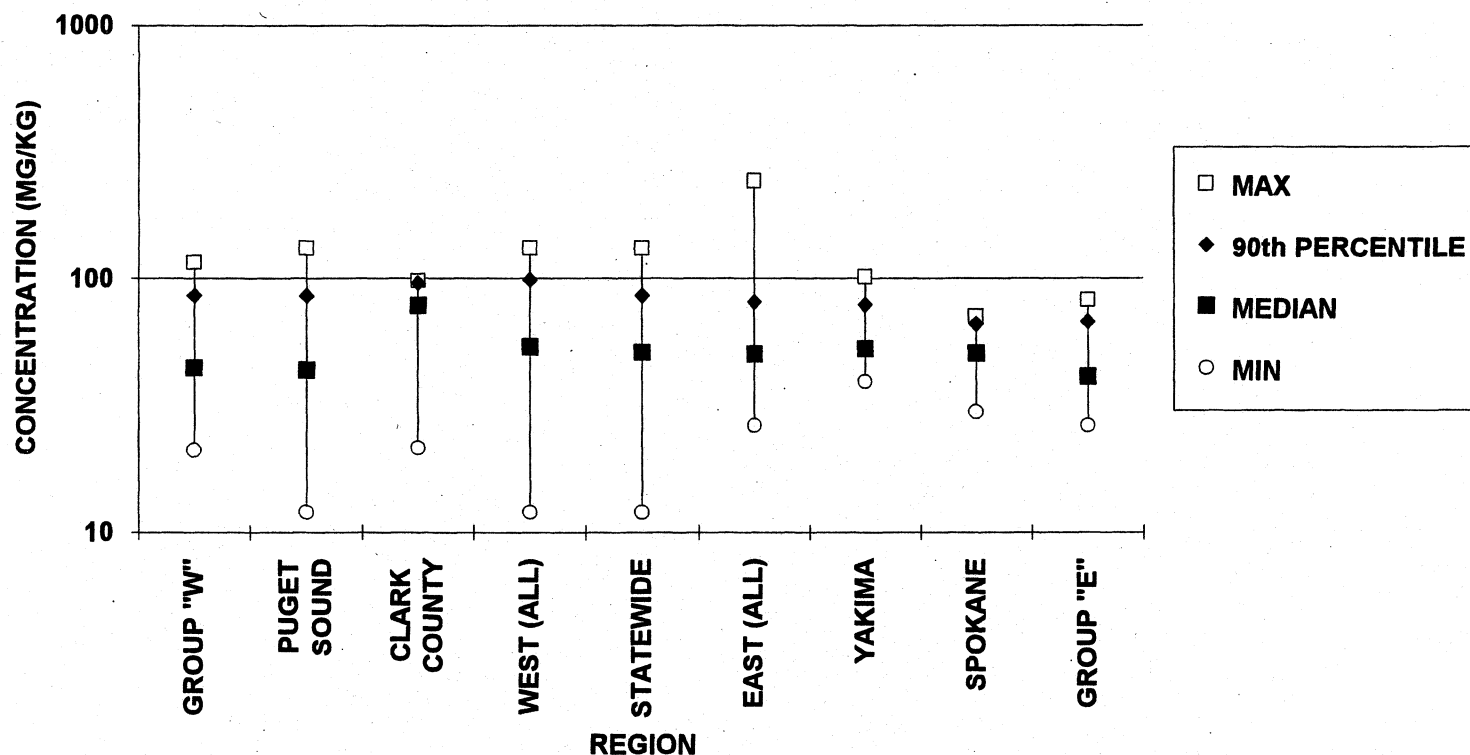


ALL VALUES = MG/KG	GROUP "W"	PUGET SOUND	CLARK COUNTY	WEST (ALL)	STATEWIDE	EAST (ALL)	YAKIMA	SPOKANE	GROUP "E"
MAX	91.10	244.50	66.75	244.50	244.50	163.00	163.00	18.60	34.10
90th PERCENTILE	54.19	38.19	21.04	44.20	38.19	24.54	45.89	16.19	22.41
MEDIAN	19.10	23.00	16.23	19.20	16.43	12.50	16.30	10.15	11.70
MIN	7.60	9.00	7.00	7.00	2.15	2.15	2.15	4.60	6.40

NOTE: GROUP "W" = WHATCOM, SKAGIT, GRAYS HARBOR, LEWIS, AND PACIFIC COUNTIES

GROUP "E" = DENTON, SPOKANE, LINCOLN, ADAMS, OKANOGAN, AND WHITMAN COUNTIES

FIGURE 22: ZINC REGIONAL ANALYSIS



ALL VALUES - MG/KG	GROUP "W"	PUGET SOUND	CLARK COUNTY	WEST (ALL)	STATEWIDE	EAST (ALL)	YAKIMA	SPOKANE	GROUP "E"
MAX	116	132.5	97.7	132.5	132.5	244.5	101.43	71	82.3
90th PERCENTILE	85.56	85.06	95.52	98.39	85.82	80.81	78.71	66.4	67.47
MEDIAN	44.5	43.65	78.5	54.075	51.12	50.64	52.9	50.9	41
MIN	21.1	12	21.4	12	12	26.3	39.3	29.7	26.3

NOTE: GROUP "W" = WHATCOM, SKAGIT, GRAYS HARBOR, LEWIS, AND PACIFIC COUNTIES

GROUP "E" = BENTON, SPOKANE, LINCOLN, ADAMS, OKANOGAN, AND WHITMAN COUNTIES

VIII. USE AND APPLICATION OF BACKGROUND VALUES

Site-Specific or Area Studies of Natural Background

The intent of this report is to provide detailed information on the natural background concentration of metals in soils throughout Washington State. However, site-specific assessments of natural or area background can still be initiated if desired. At least ten samples must be collected for a site-specific study into natural background and at least 20 are required for area background (Ch 173-340-708 11 (d) WAC).

Use of the Statewide and Regional Values

Statewide and regional 90th percentile values for the Puget Sound Basin, Clark County, Yakima Basin, and Spokane Basin are presented in Table 6. The statewide values can be used for any purpose (i.e., comparison against data from toxic waste sites, waste streams, etc.) and there are no restrictions on the use of this data. The regional 90th percentile values for Puget Sound, Clark County, Yakima Basin, and Spokane Basin are to be compared against data from those regions only (see Table 12 below).

Table 12: Counties Encompassed by Regional Background Values

Region	Counties
Puget Sound Basin	Clallam, Jefferson, Mason, Thurston, Pierce, King, Kitsap, Island, Snohomish
Clark County	Clark, Cowlitz, Skamania
Yakima Basin	Yakima, Kittitas, Klickitat, Chelan, Benton
Spokane Basin	Spokane, Lincoln, Adams, Whitman

Other Areas

Sites that are not located within the four main regional areas may use the statewide values or the 10 sampling locations (see latitude/longitude coordinates, data tables) that are closest to a given site or area.

Application of Background Values

When comparing cleanup- or contaminated-site data against background values, the 95 % upper confidence limit (UCL) of a given data set is compared against the 90th percentile of the background data set. Please refer to Ecology's publication entitled *Statistical Guidance for Ecology Site Managers* (August, 1992). Detailed instructions on how to derive soil cleanup standards based on background standards are included in that document. Please use caution when comparing individual data points against the 90th percentile value of the background data set. When comparing individual

data points against the 90th percentile value, there is a 10% chance that an individual data point will exceed the 90th percentile value.

Alternative Procedures

The 90th percentile has been selected by Ecology as the default assumption for determining background. If background values are used as cleanup levels, no single sample concentration shall be greater than two times the 90th percentile value and less than ten percent of the sample concentrations shall exceed the 90th percentile value (Ch 173-340-740 (7) (e), see Table 13). However, alternative procedures for determining background are allowed. Specifically, a numerical cleanup standard is established, based on different data evaluation procedures. This could be the result of site-specific characteristics, such as the form of the background data distribution, its coefficient of variation (CV) or degree of skew, the number of samples available, or other such factors. For more information on alternative procedures for determining background, consultant Ecology's *Statistical Guidance for Site Managers* (August, 1992, see flowchart of p. 38 for alternative procedures).

TABLE 13: 90th PERCENTILE VALUES**ALL VALUES = MG/KG**

	Al		As		Be		Cd		Cr		Cu	
GROUP "W"	62,905	125,810	8.47	16.9	0.8	1.5	0.1	0.2	78.5	156.9	52.9	105.7
PUGET SOUND	32,581	65,162	7.30	14.6	0.6	1.2	0.8	1.5	48.2	96.3	36.4	72.7
CLARK COUNTY	52,276	104,552	5.81	11.6	2.1	4.1	0.9	1.9	26.6	53.1	34.4	68.9
WEST (ALL)	45,735	91,470	6.37	12.7	1.5	3.0	1.2	2.4	47.4	94.8	43.2	86.5
STATEWIDE	37,206	74,412	6.99	14.0	1.4	2.9	1.0	2.0	41.9	83.8	36.0	72.0
EAST (ALL)	28,299	56,598	7.61	15.2	1.3	2.5	0.8	1.6	31.9	63.8	28.4	56.8
YAKIMA BASIN	33,379	66,758	5.13	10.3	1.6	3.1	0.9	1.9	38.3	76.5	26.5	52.9
SPOKANE BASIN	21,376	42,752	9.34	18.7	0.8	1.7	0.7	1.4	17.8	35.6	21.6	43.2
GROUP "E"	25,591	51,182	5.76	11.5	0.6	1.2	N/A	N/A	37.8	75.6	28.4	56.8

	Fe		Hg		Mn		Ni		Pb		Zn	
GROUP "W"	49,170	98,340	0.13	0.26	691.8	1,384	54.2	108.4	10.9	21.7	85.6	171.1
PUGET SOUND	36,128	72,256	0.07	0.14	1146.0	2,292	38.2	76.4	16.8	33.7	85.1	170.1
CLARK COUNTY	58,665	117,330	0.04	0.08	1511.0	3,022	21.0	42.1	24.0	48.0	95.5	191.0
WEST (ALL)	50,125	100,250	0.08	0.16	1337.3	2,675	44.2	88.4	20.4	40.8	98.4	196.8
STATEWIDE	43,106	86,212	0.07	0.14	1094.9	2,190	38.2	76.4	17.1	34.2	85.8	171.6
EAST (ALL)	36,644	73,288	0.04	0.08	836.0	1,672	24.5	49.1	13.1	26.2	80.9	161.8
YAKIMA BASIN	51,451	102,902	0.05	0.10	1104.8	2,210	45.9	91.8	11.0	22.0	78.7	157.4
SPOKANE BASIN	25,026	50,052	0.02	0.04	663.5	1,327	16.2	32.4	14.9	29.8	66.4	132.8
GROUP "E"	29,631	59,262	0.02	0.04	526.6	1,053	22.4	44.8	9.9	19.7	67.5	134.9

SHADED COLUMN = TWICE THE 90th PERCENTILE VALUE

NOTE ON COMPLIANCE MONITORING: A) NO SINGLE SAMPLE CONCENTRATION SHALL BE GREATER THAN TWO TIMES THE 90th PERCENTILE VALUE, B) LESS THAN TEN PERCENT OF THE SAMPLE CONCENTRATIONS SHALL EXCEED THE SOIL CLEANUP LEVEL. Ch 173-340-740 (7) (e) WAC.

IX. SCATTER PLOTS, DISTRIBUTION GRAPHS, & CONCENTRATION MAPS

Summary

Scatter plots, statistical distribution graphs, and statewide concentration maps for the 12 elements are presented in this section. The statewide concentration maps were prepared by Ecology's Environmental Investigation and Laboratory Services Program (EILS) via use of their geographic information system (GIS). The XY scatter plots were prepared using Microsoft Excel.

FIGURE 23: ALUMINUM X,Y SCATTER PLOT

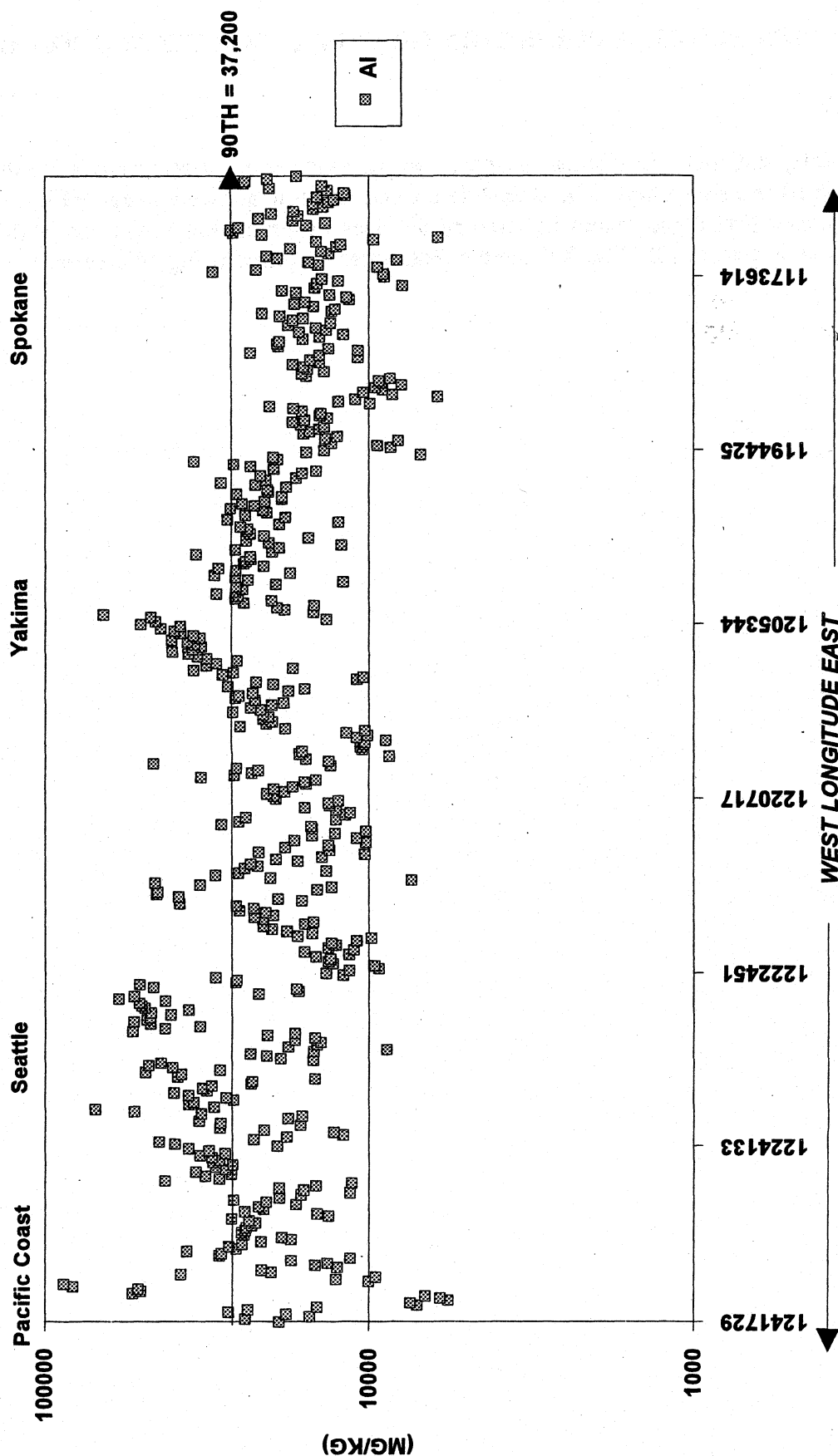
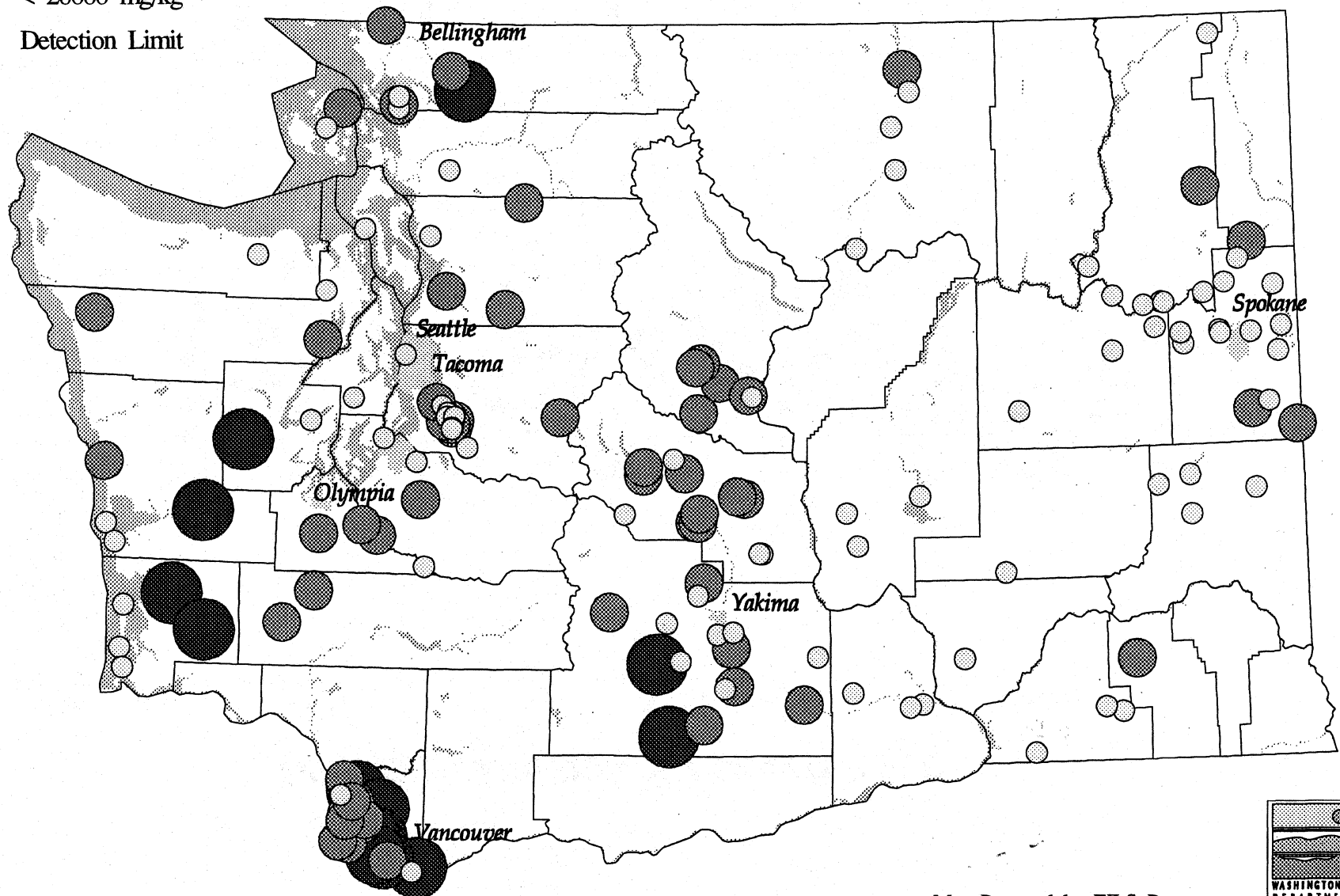
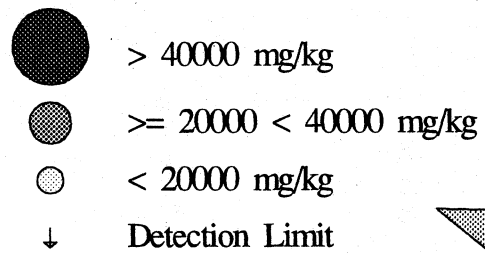


Figure 24: Aluminum Concentrations

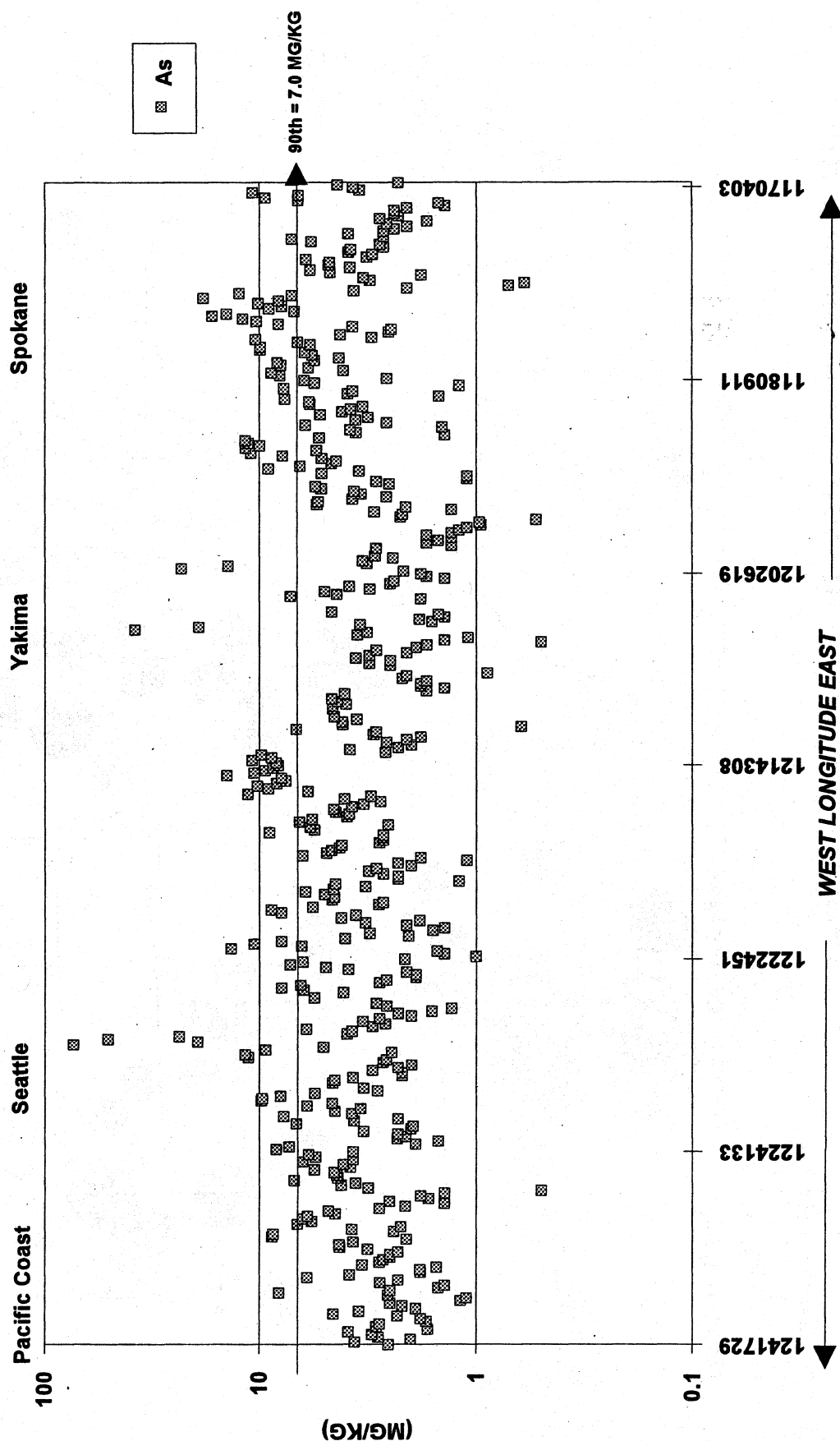


Map Prepared by EILS Program



NOTE: PLOT IS BASED ON GRAPHITE FURANCE ATOMIC ABSORPTION (GFAA) ANALYSIS.

FIGURE 25: ARSENIC X,Y SCATTER PLOT



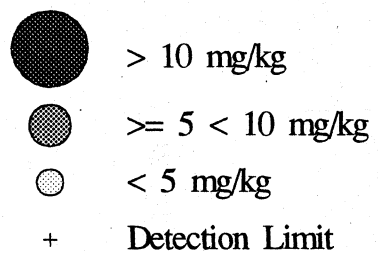
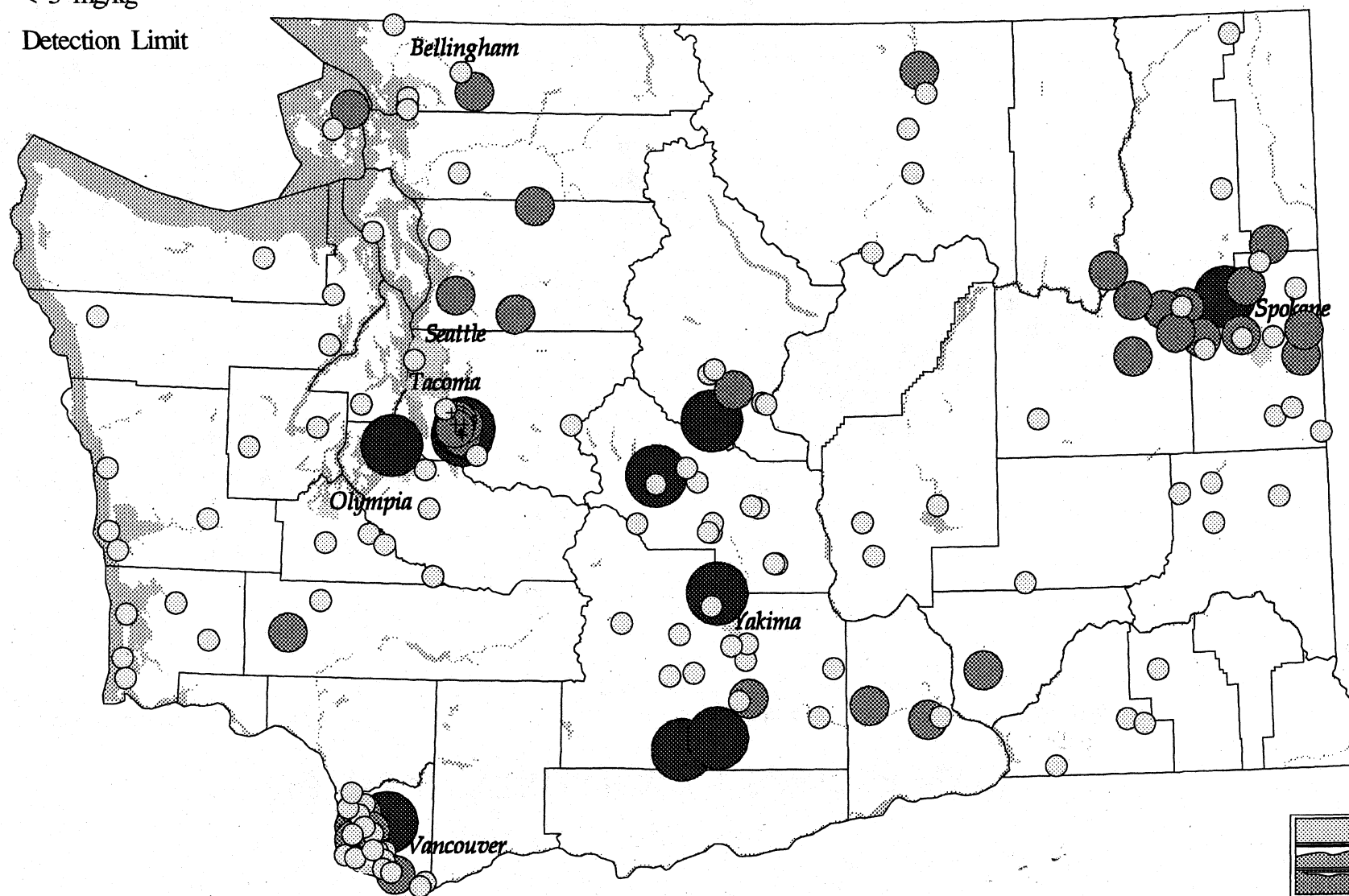


Figure 26: Arsenic Concentrations



Map Prepared by EILS Program

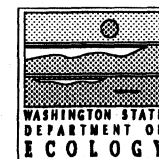


FIGURE 27: BERYLLIUM X,Y SCATTER PLOT

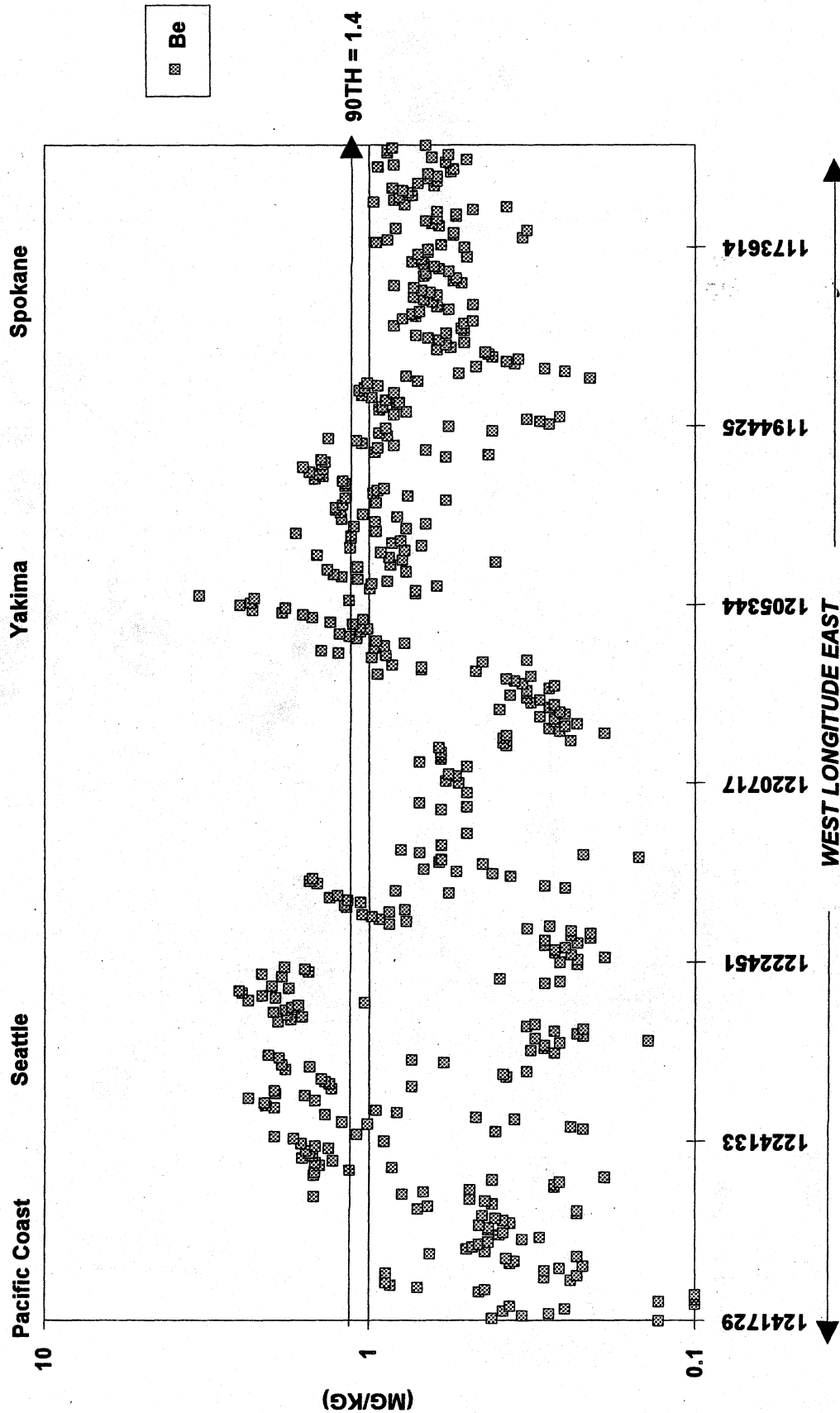
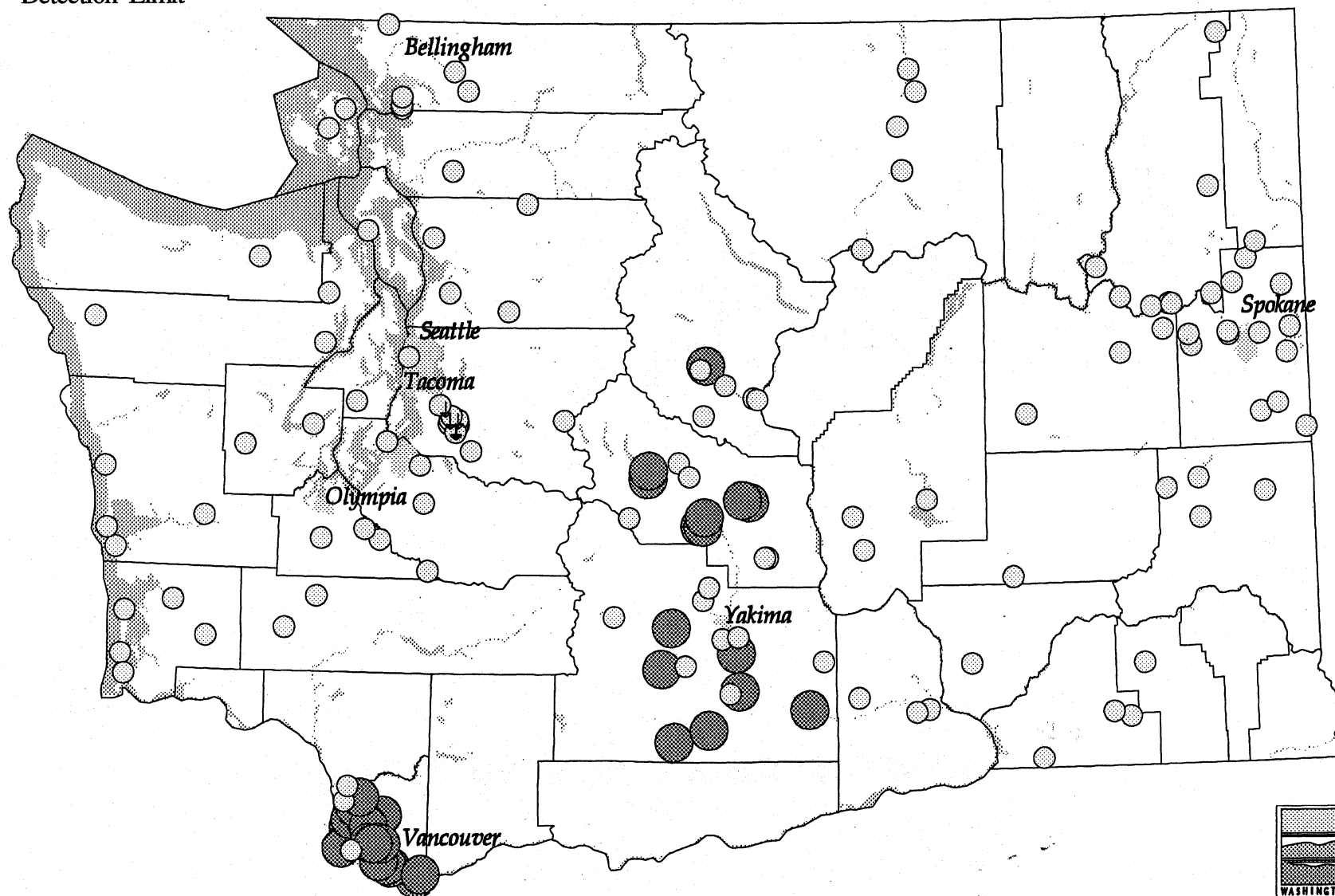


Figure 28: Beryllium Concentrations

- > 1 mg/kg
- < 1 mg/kg
- ↓ Detection Limit



Map Prepared by EILS Program



FIGURE 29: CADMIUM X,Y SCATTER PLOT

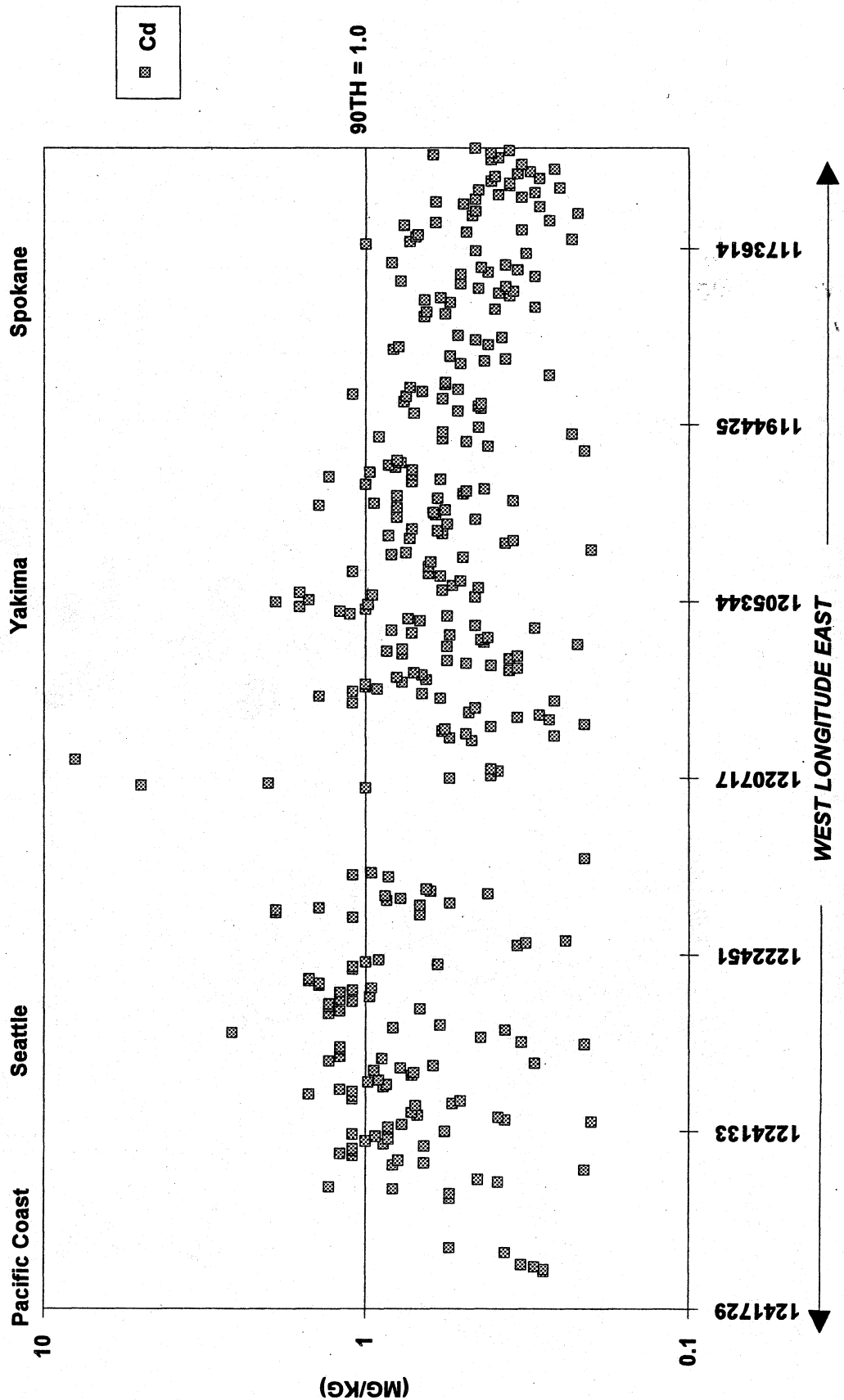


Figure 30: Cadmium Concentrations

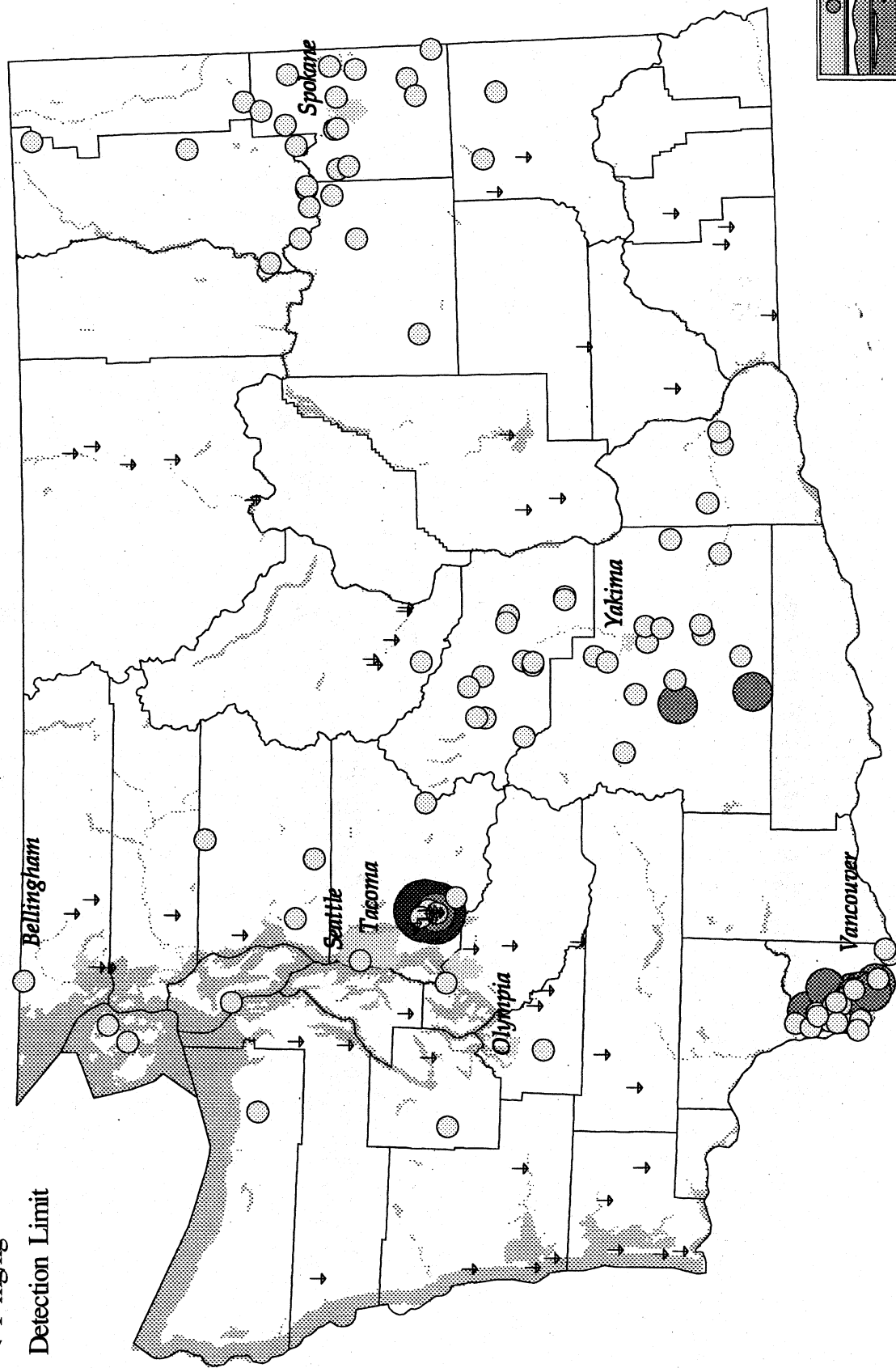
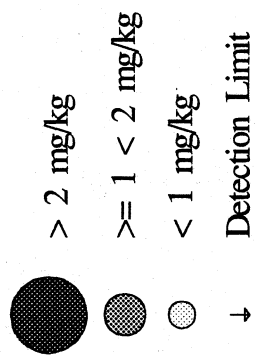


FIGURE 31: CHROMIUM X,Y SCATTER PLOT

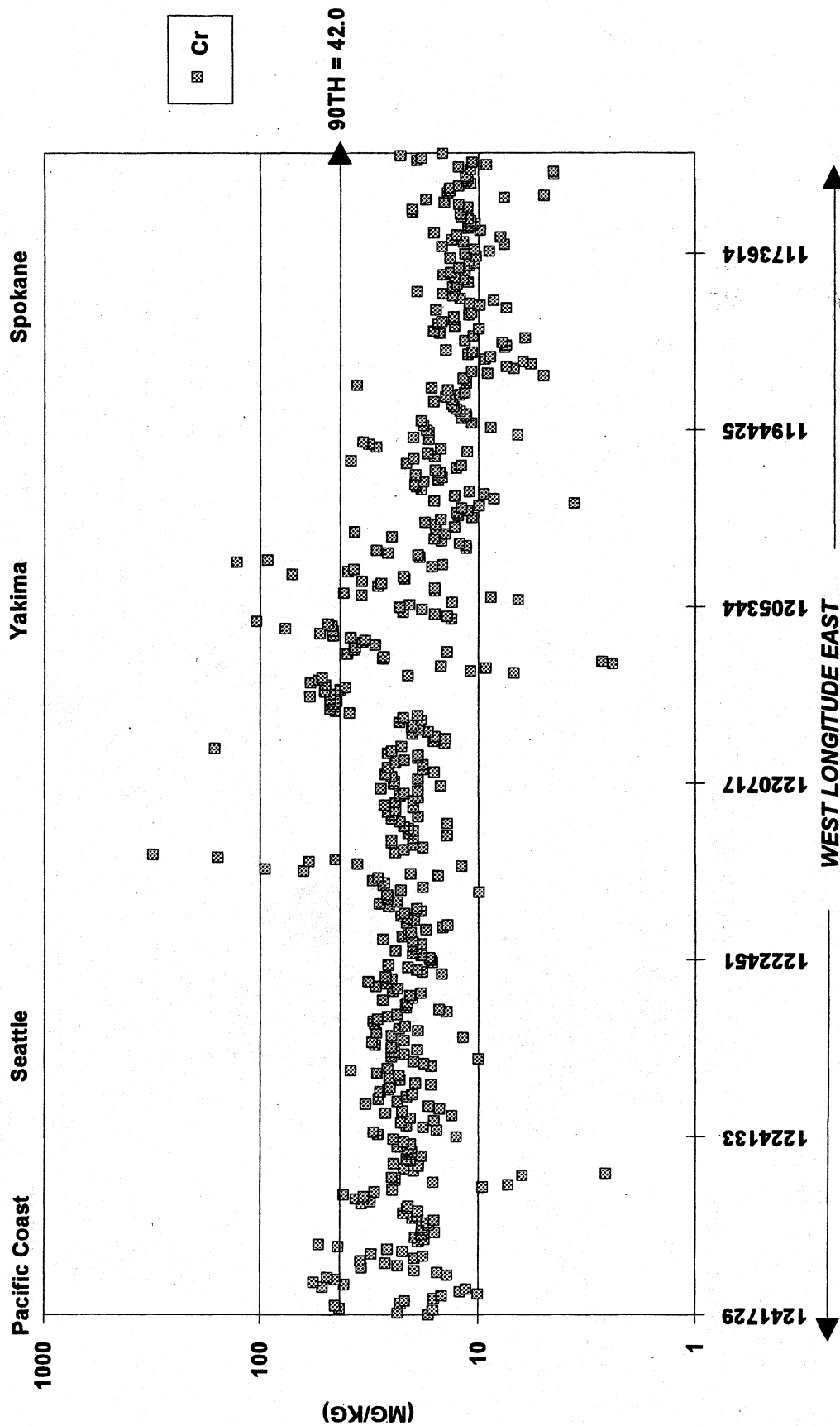
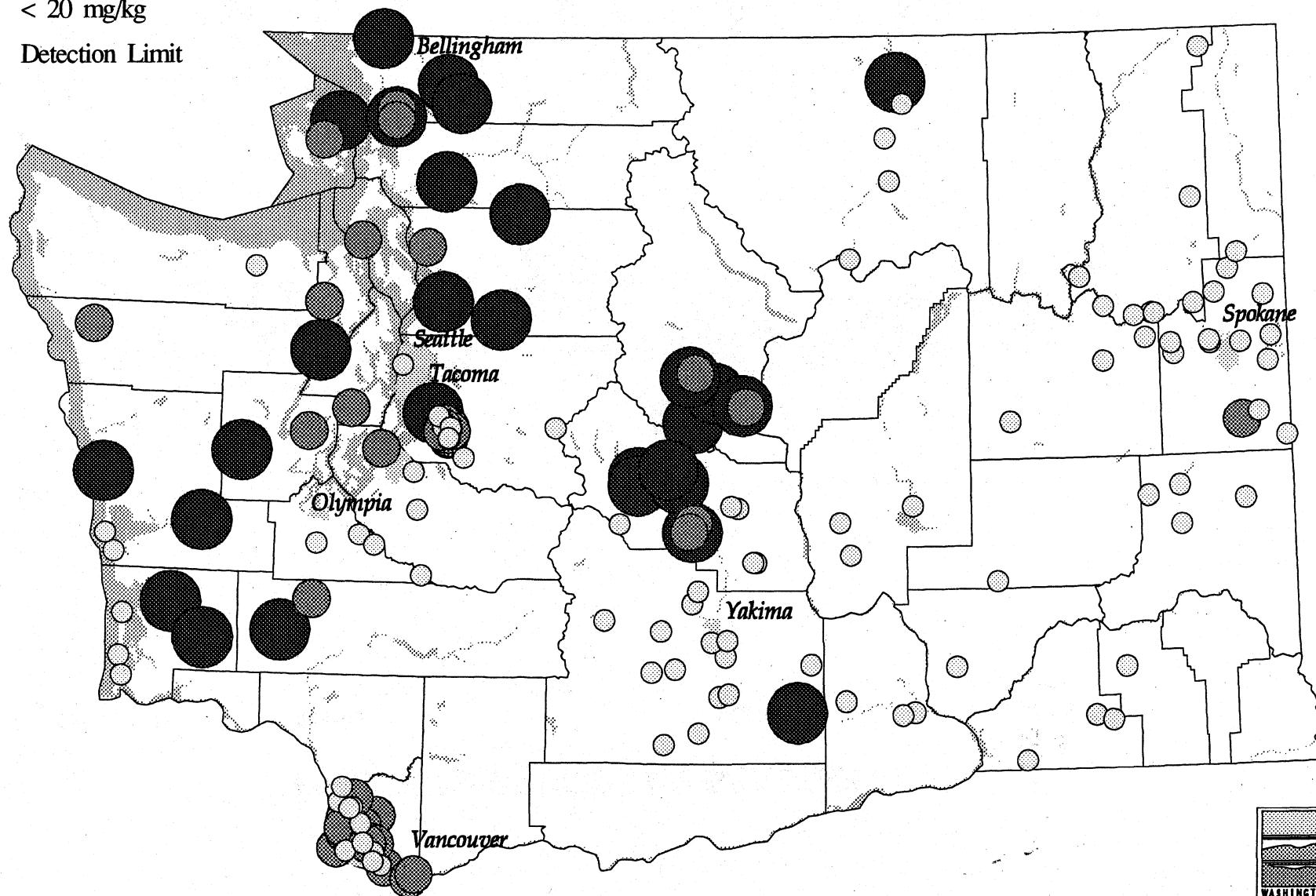
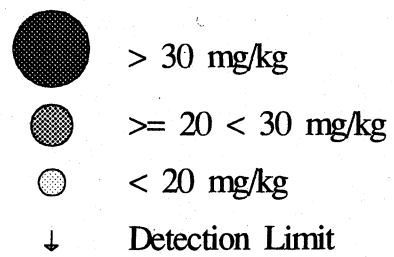


Figure 32: Chromium Concentrations



Map Prepared by EILS Program



FIGURE 33: COPPER X,Y SCATTER PLOT

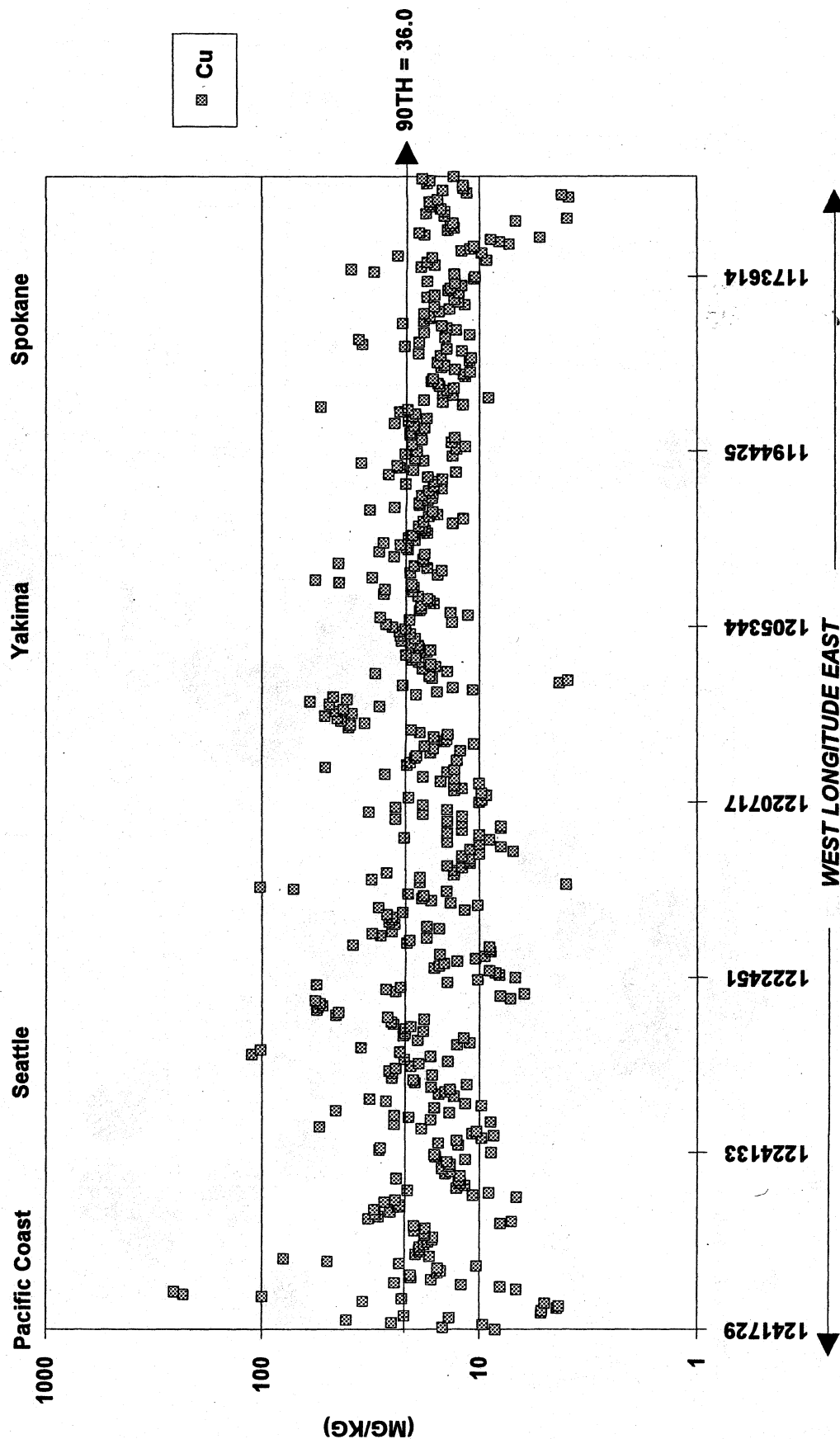
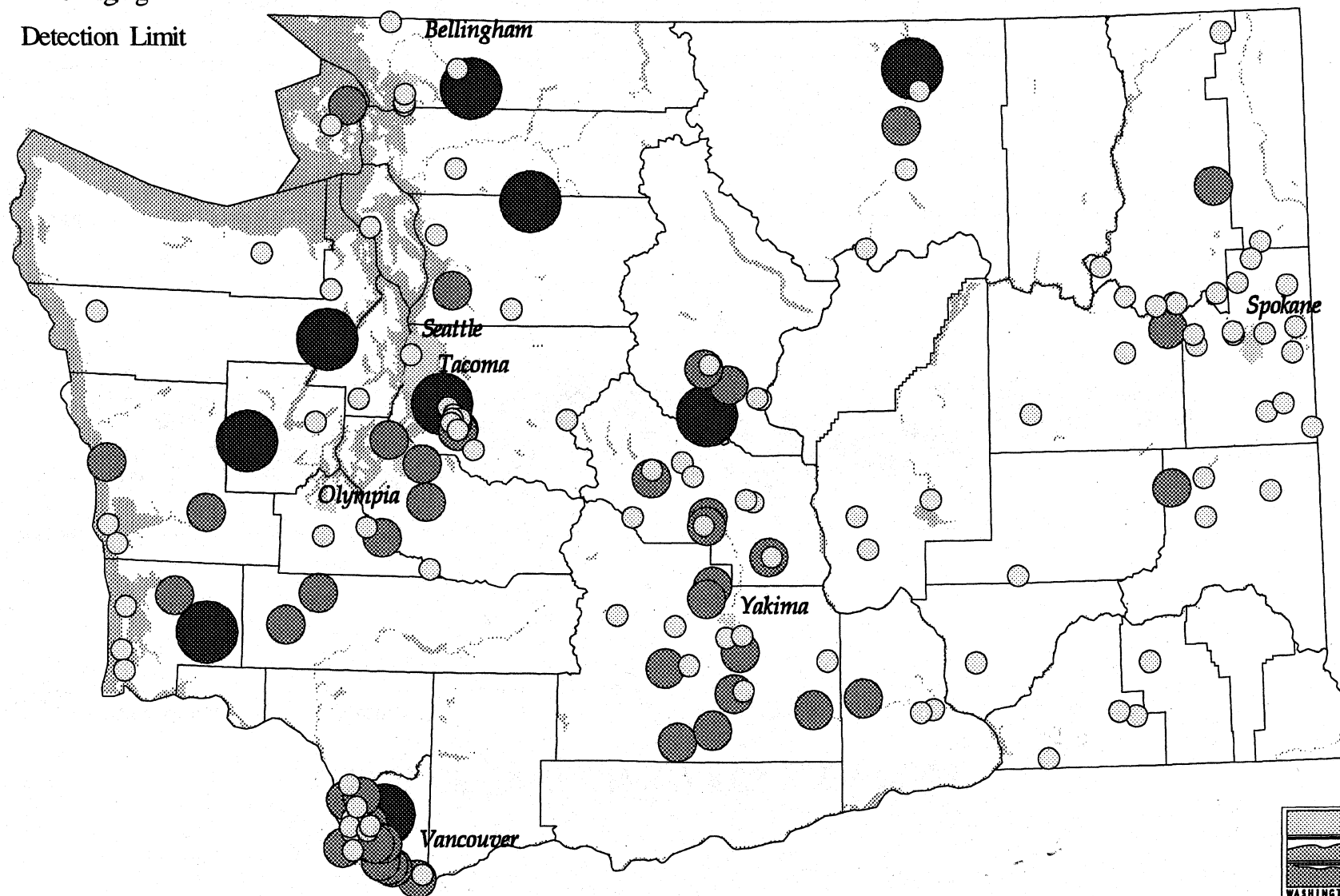
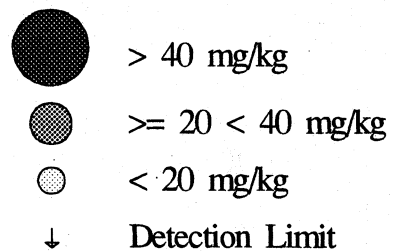


Figure 34: Copper Concentrations



Map Prepared by EILS Program



FIGURE 35: IRON X,Y SCATTER PLOT

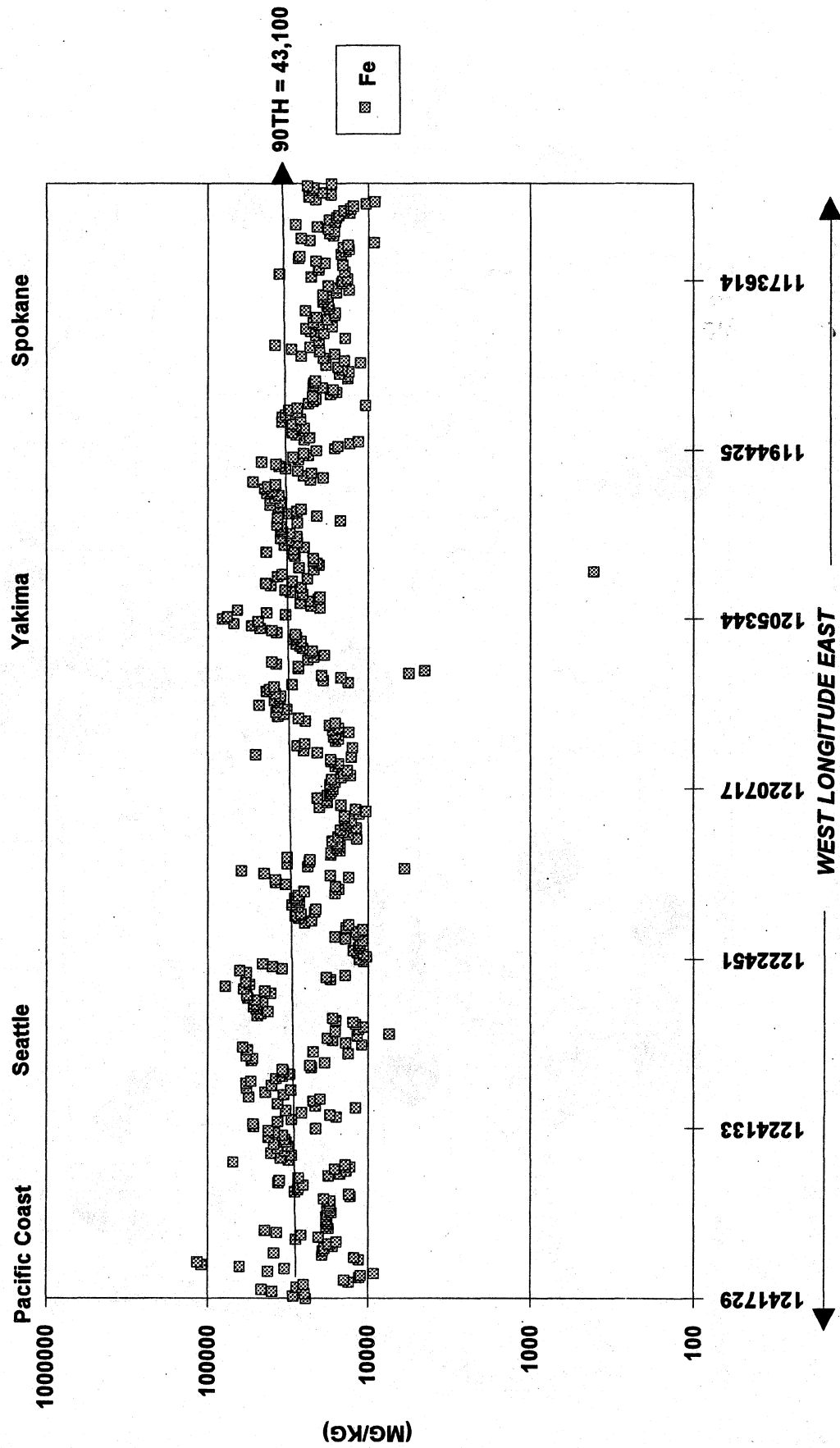
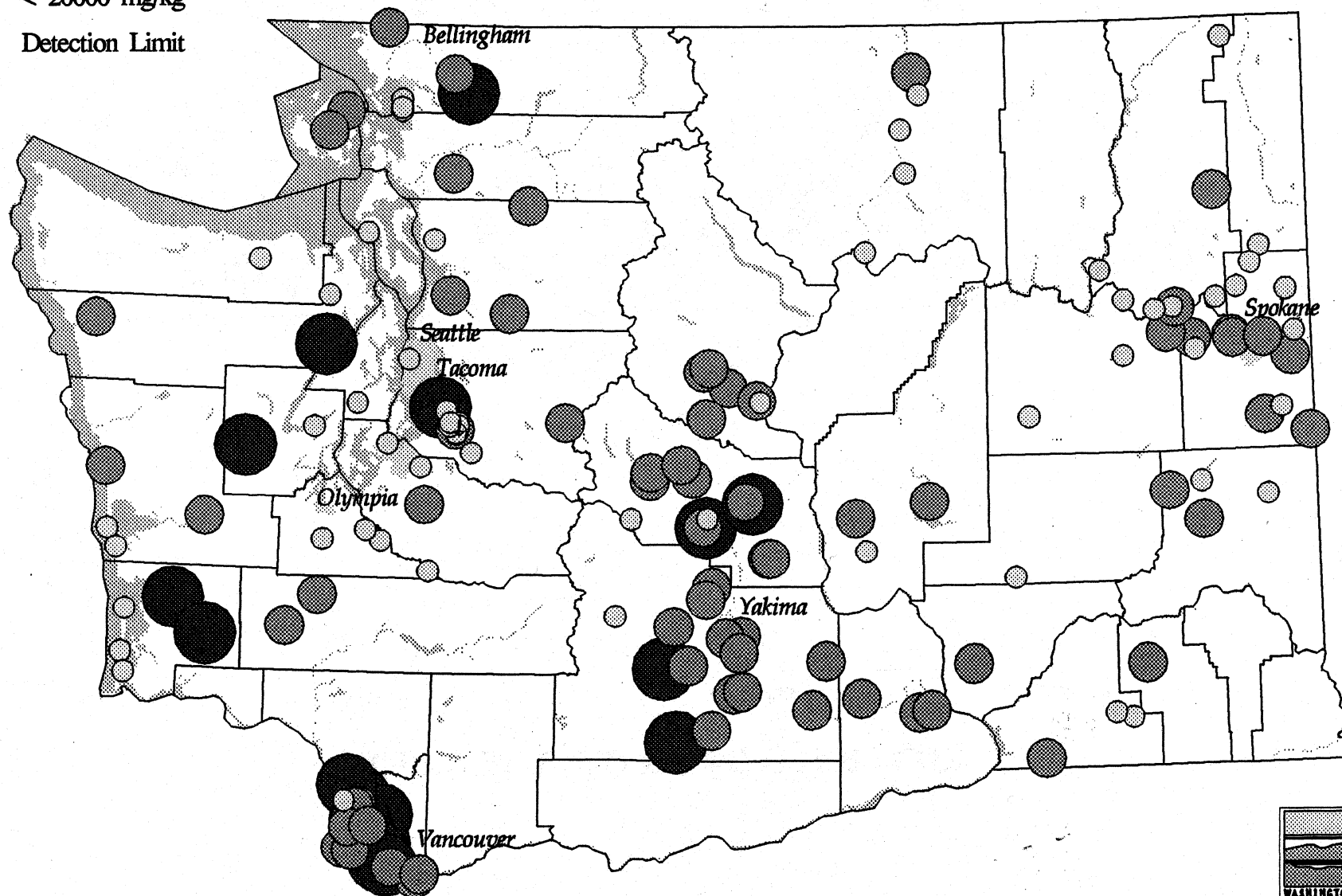
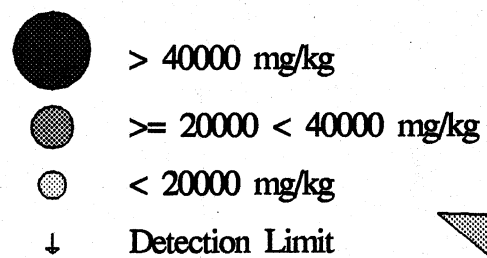


Figure 36: Iron Concentrations



Map Prepared by EILS Program

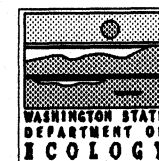


FIGURE 37: LEAD X, Y SCATTER PLOT

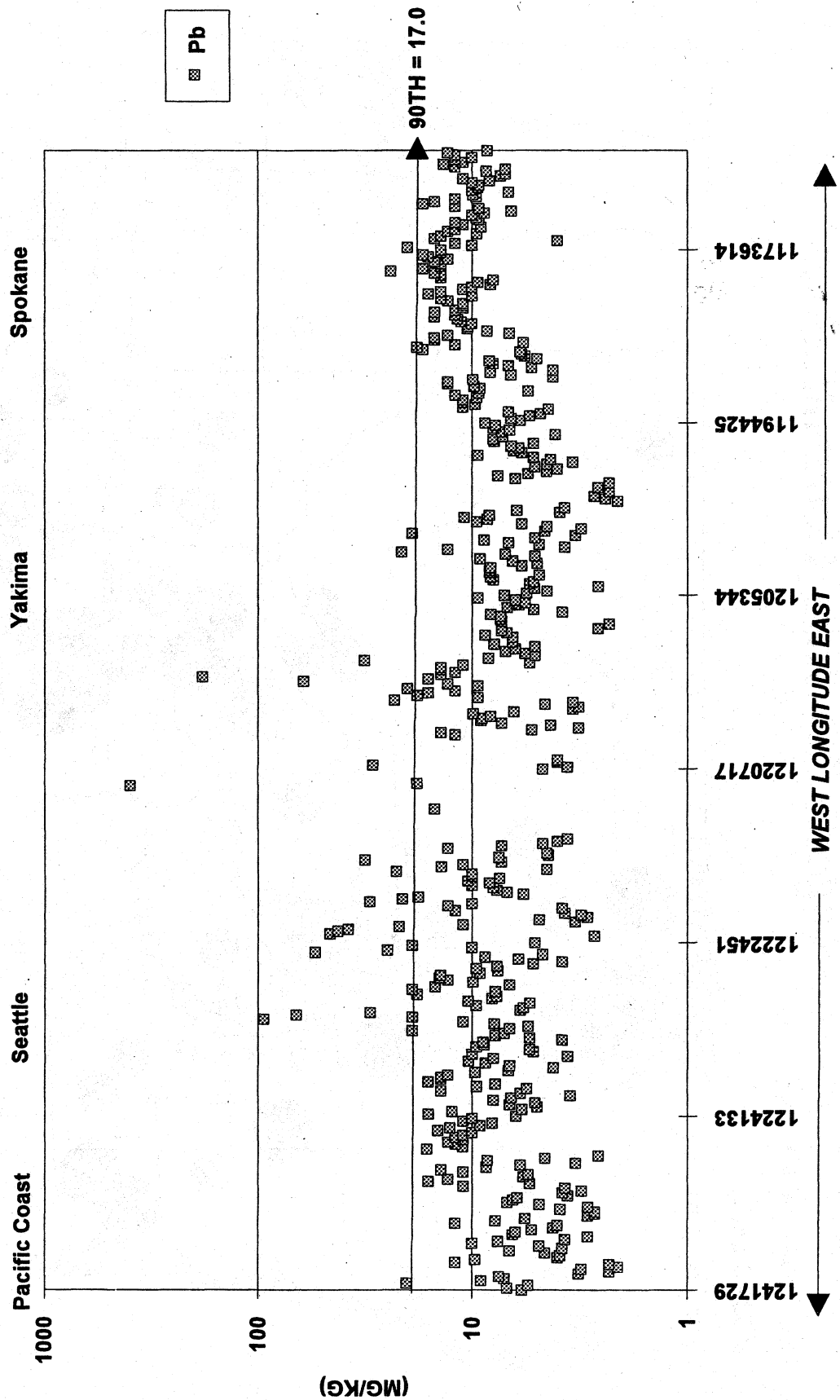
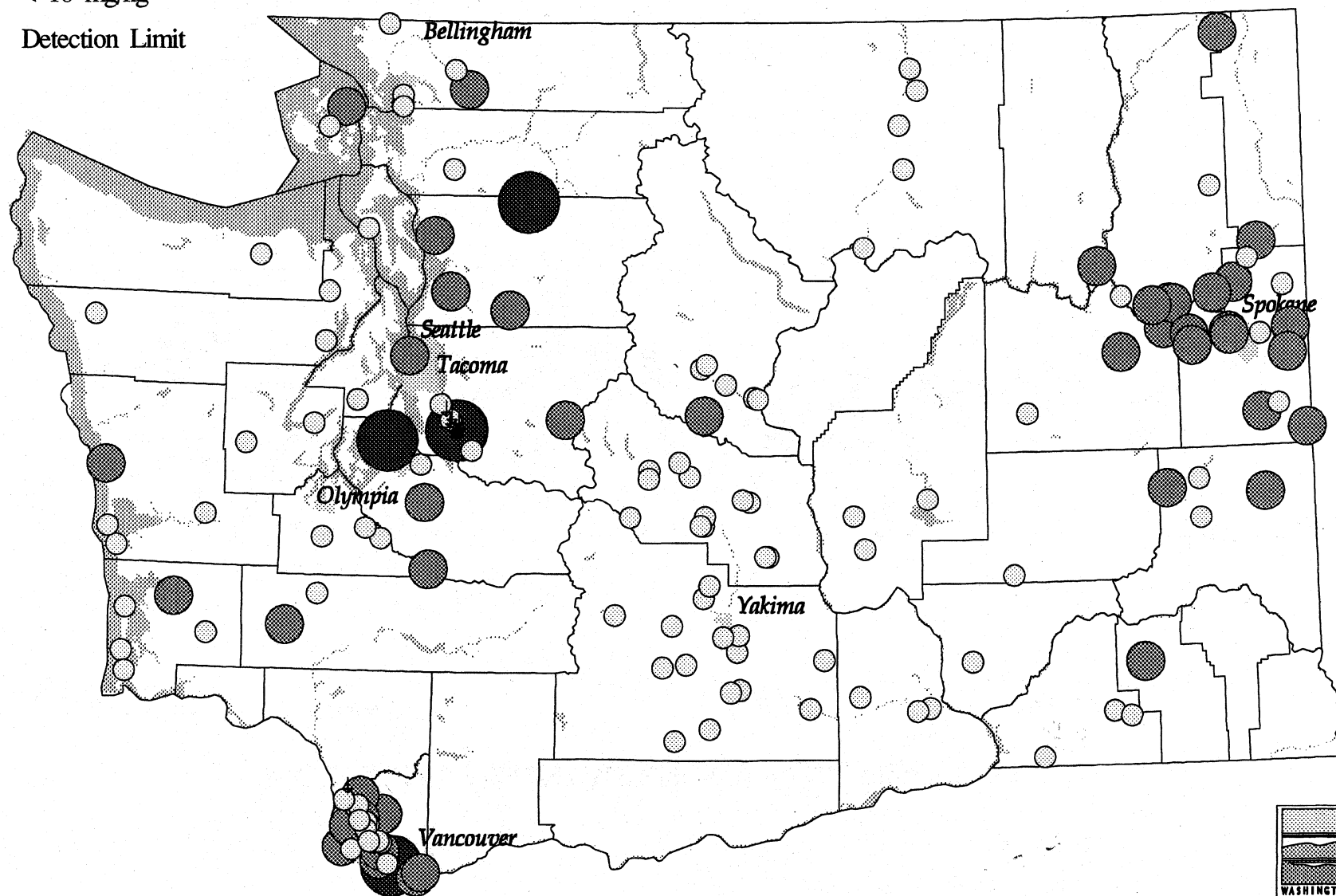
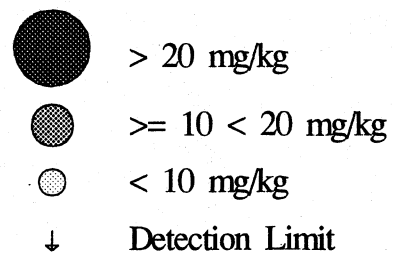


Figure 38: Lead Concentrations



Map Prepared by EILS Program

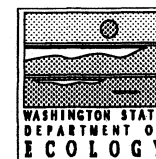


FIGURE 39: MANGANESE X,Y SCATTER PLOT

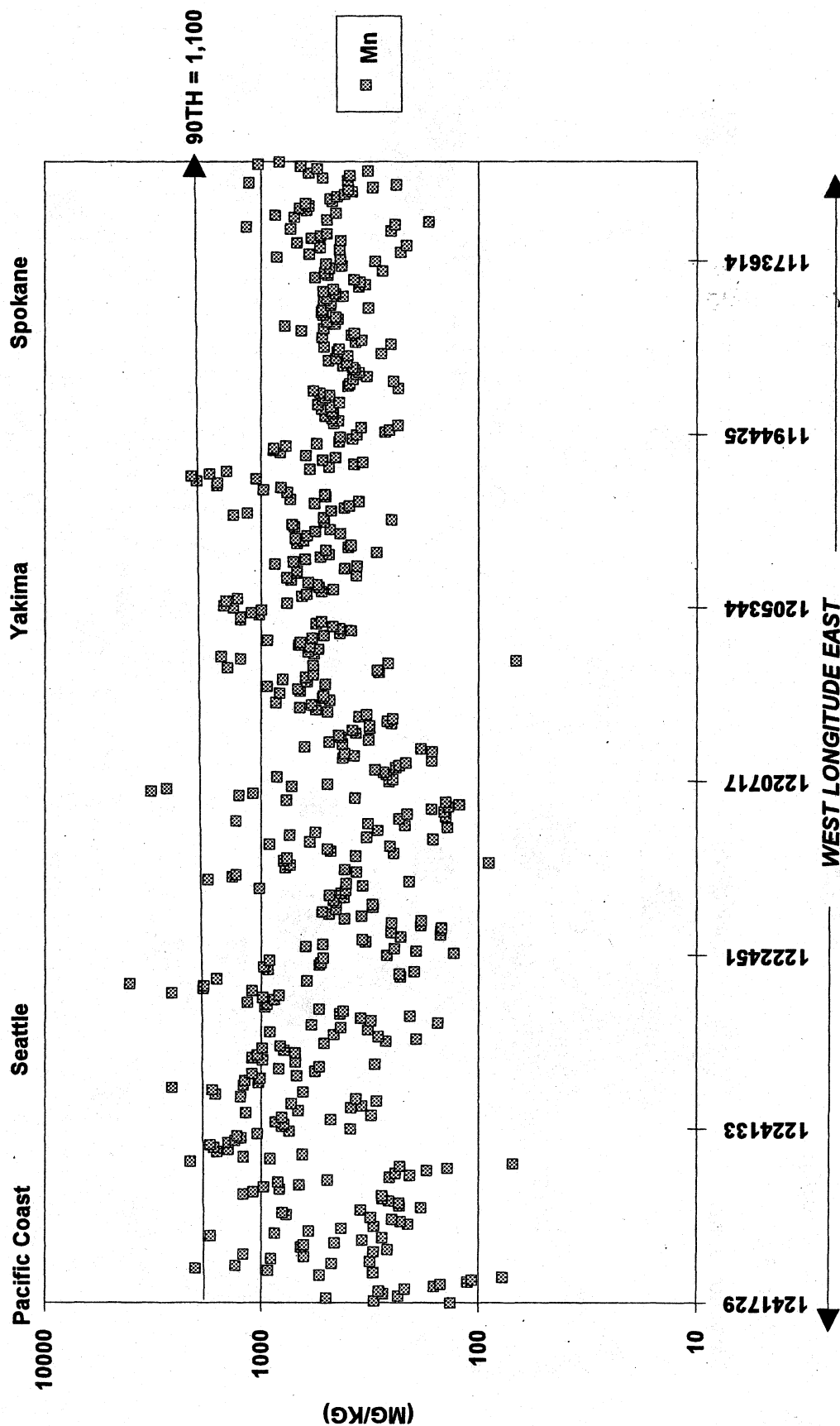
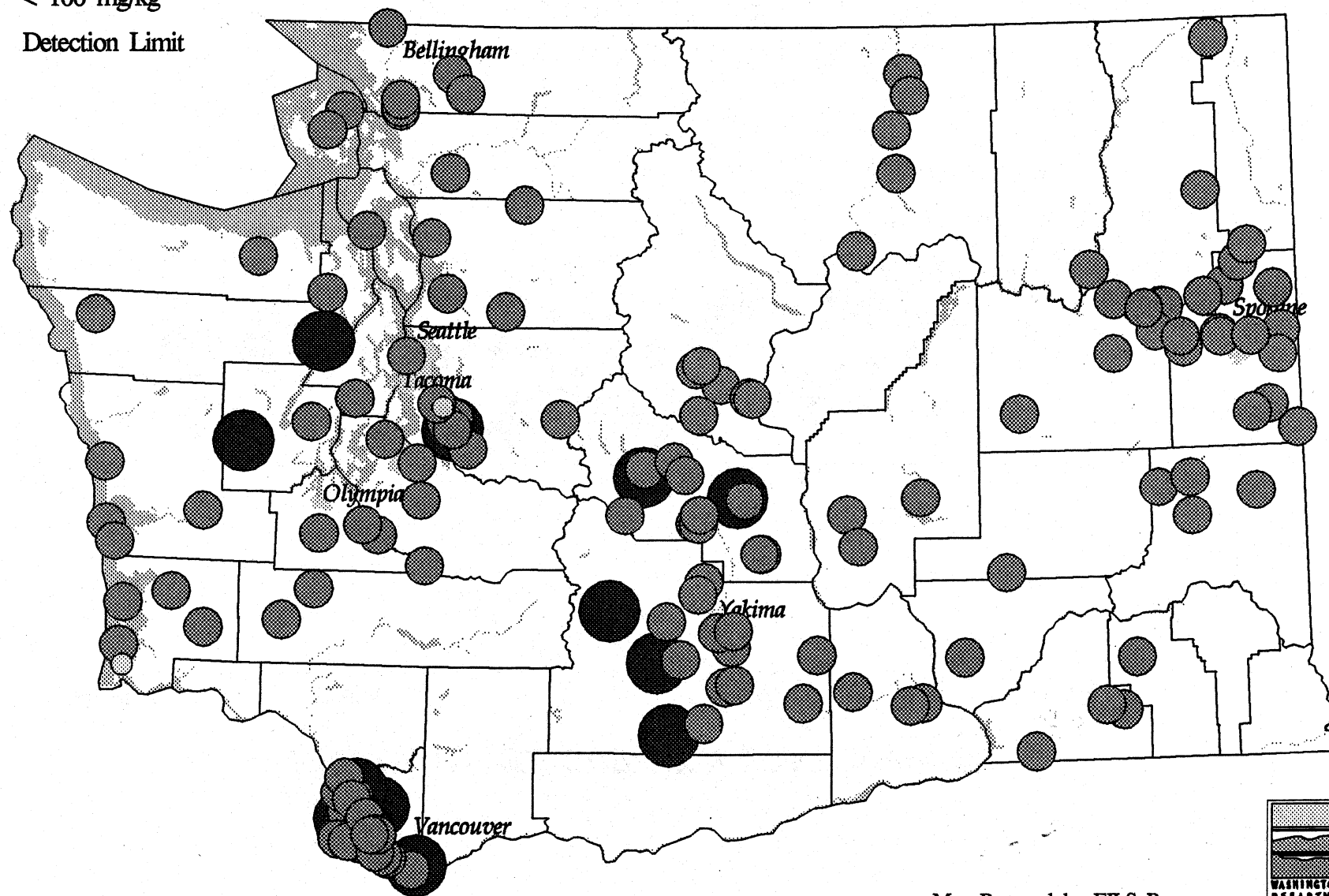
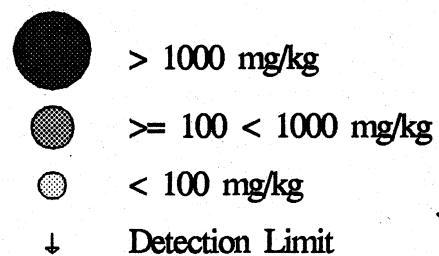


Figure 40: Manganese Concentrations



Map Prepared by EILS Program



FIGURE 41: MERCURY X,Y SCATTER PLOT

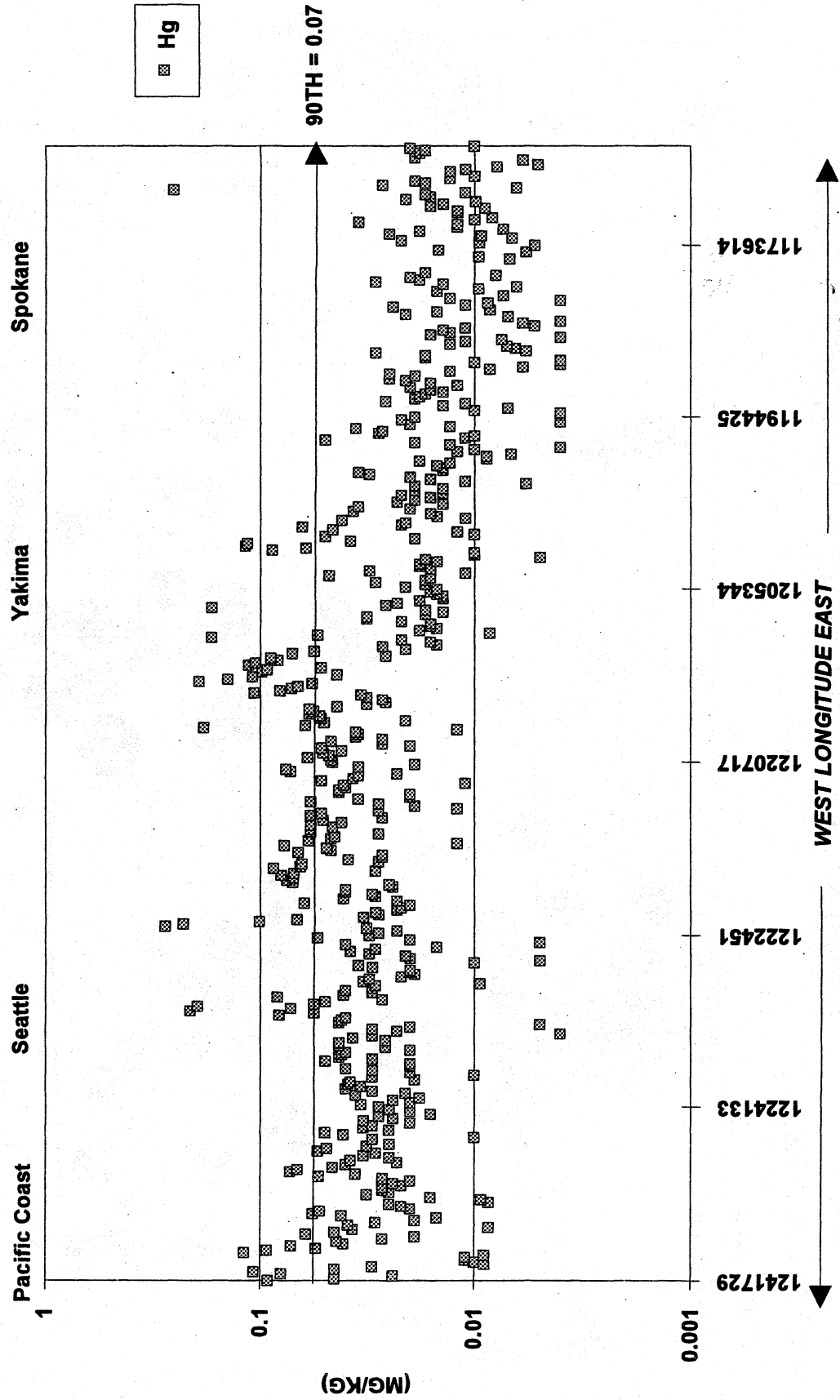
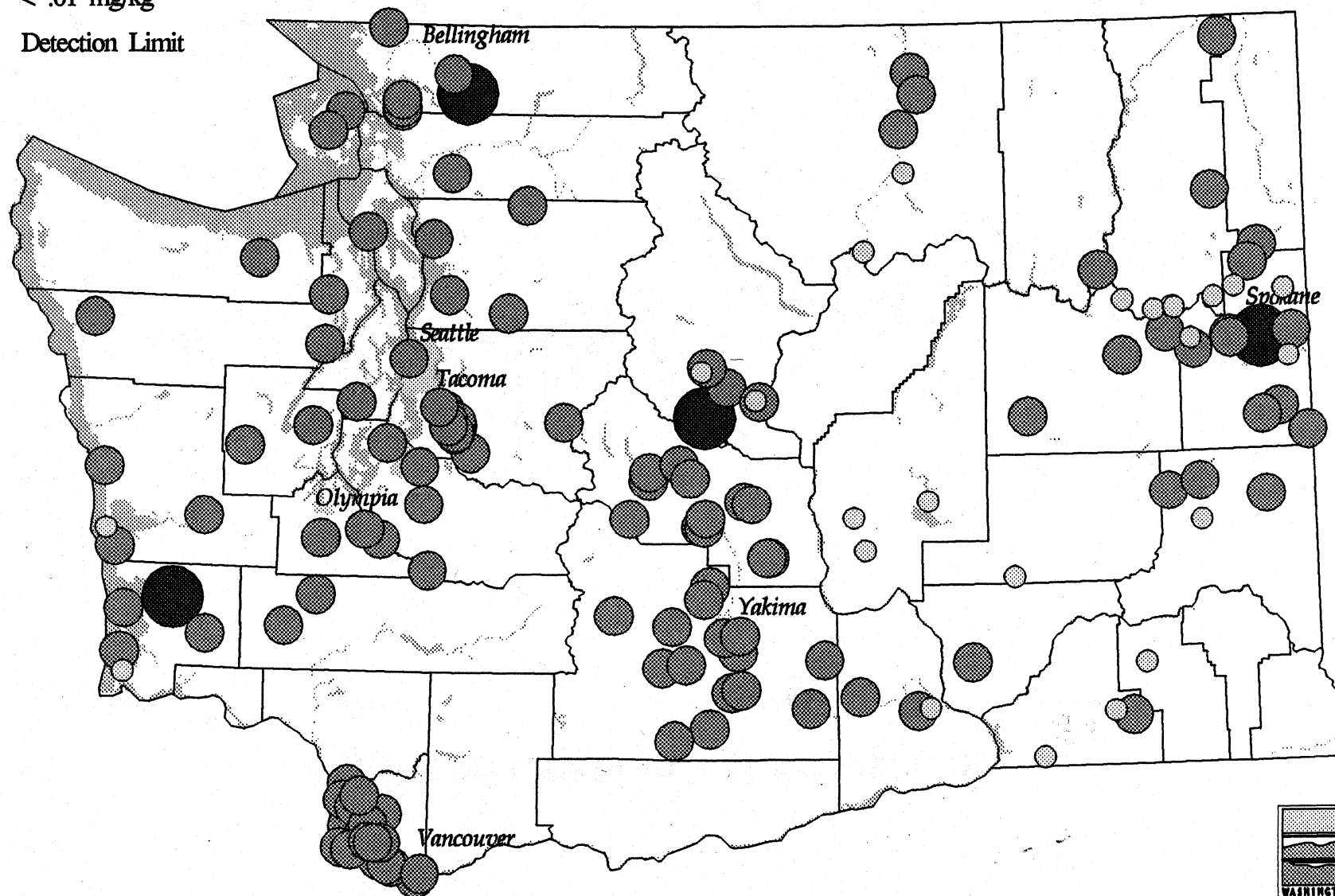
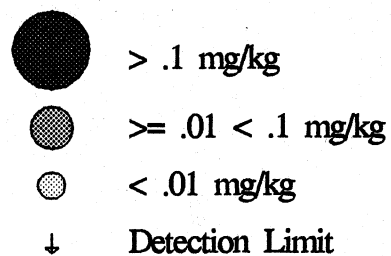


Figure 42: Mercury Concentrations



Map Prepared by EILS Program



FIGURE 43: NICKEL X,Y SCATTER PLOT

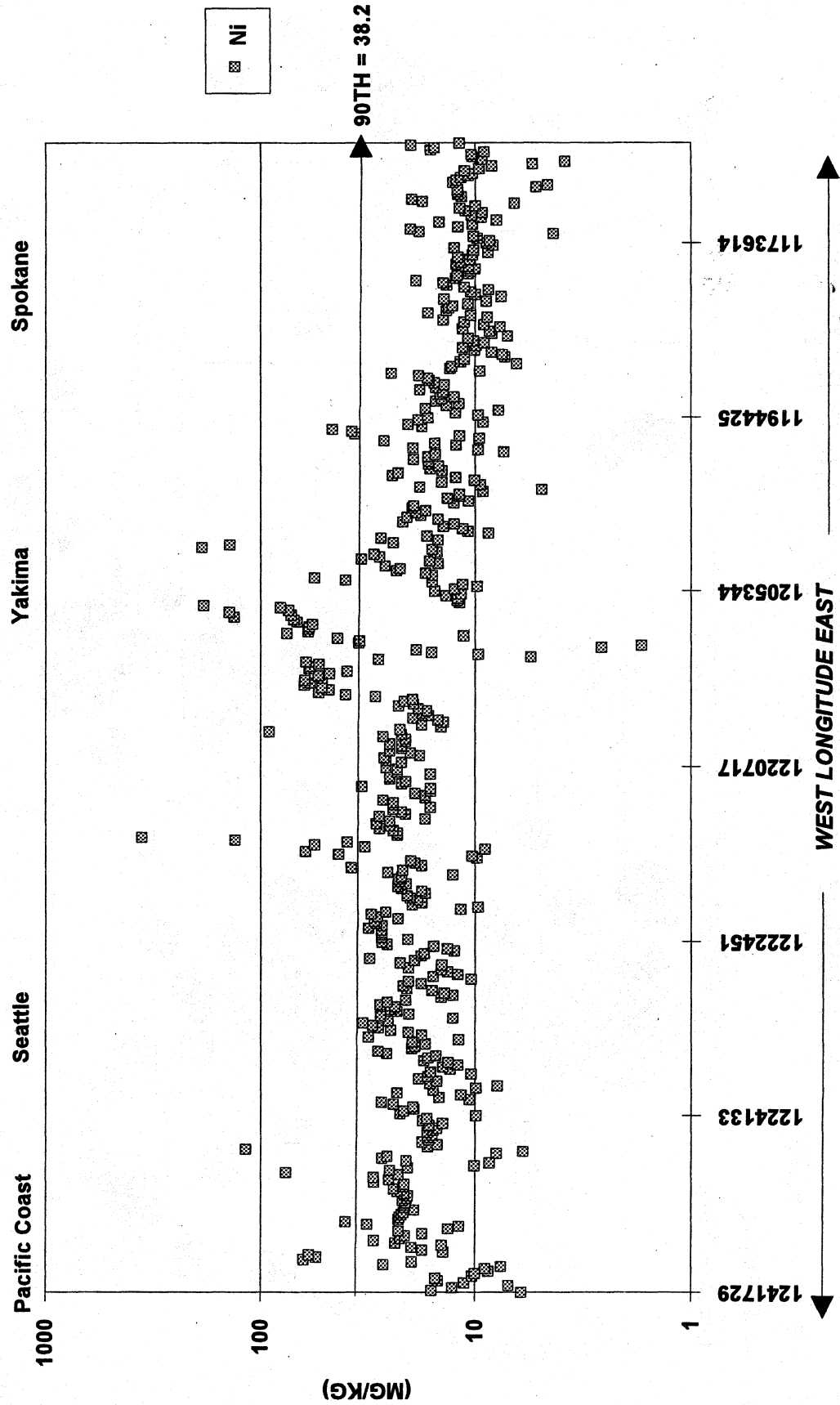
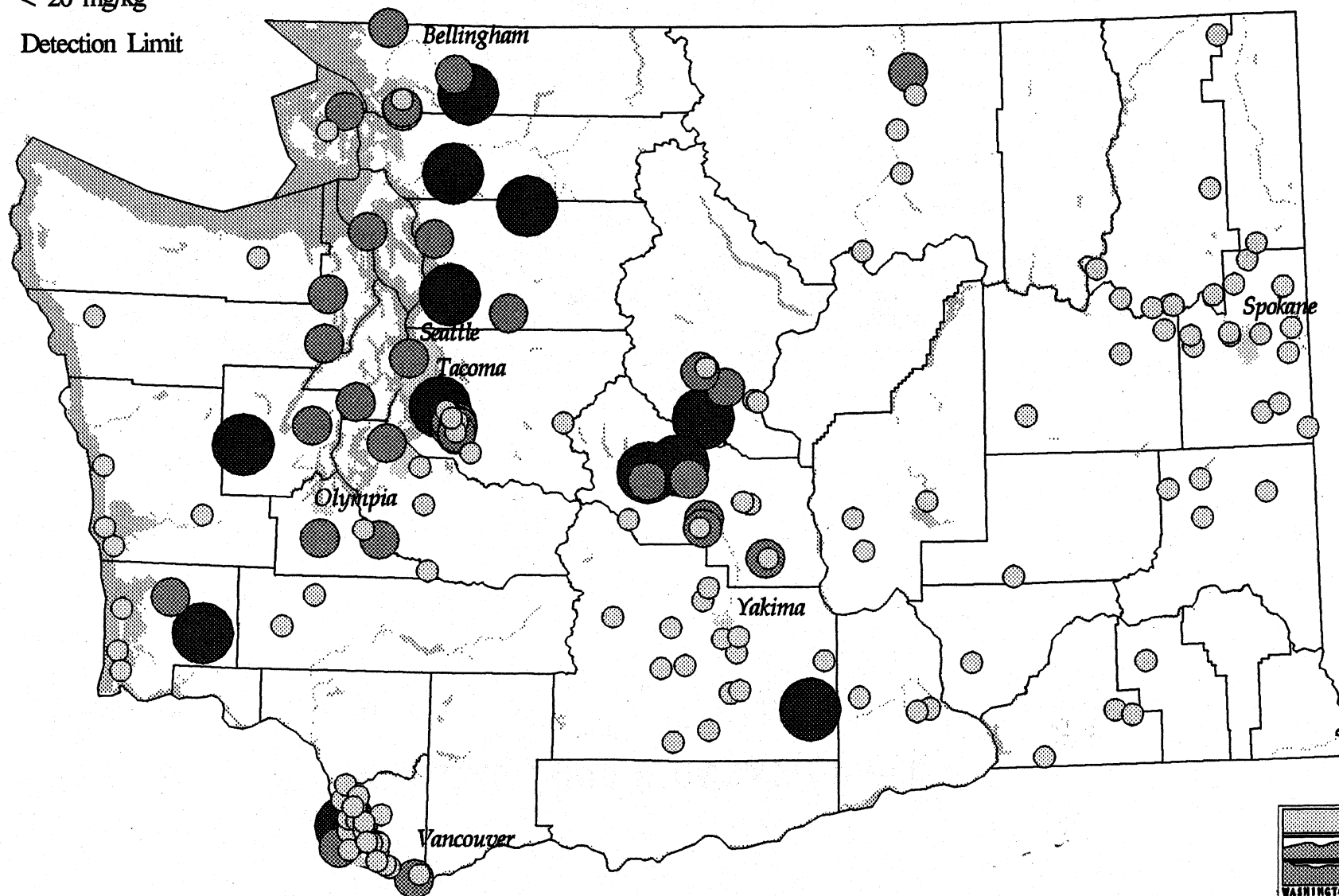
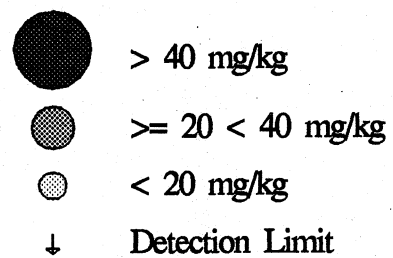


Figure 44: Nickel Concentrations



Map Prepared by EILS Program



FIGURE 45: ZINC X,Y SCATTER PLOT

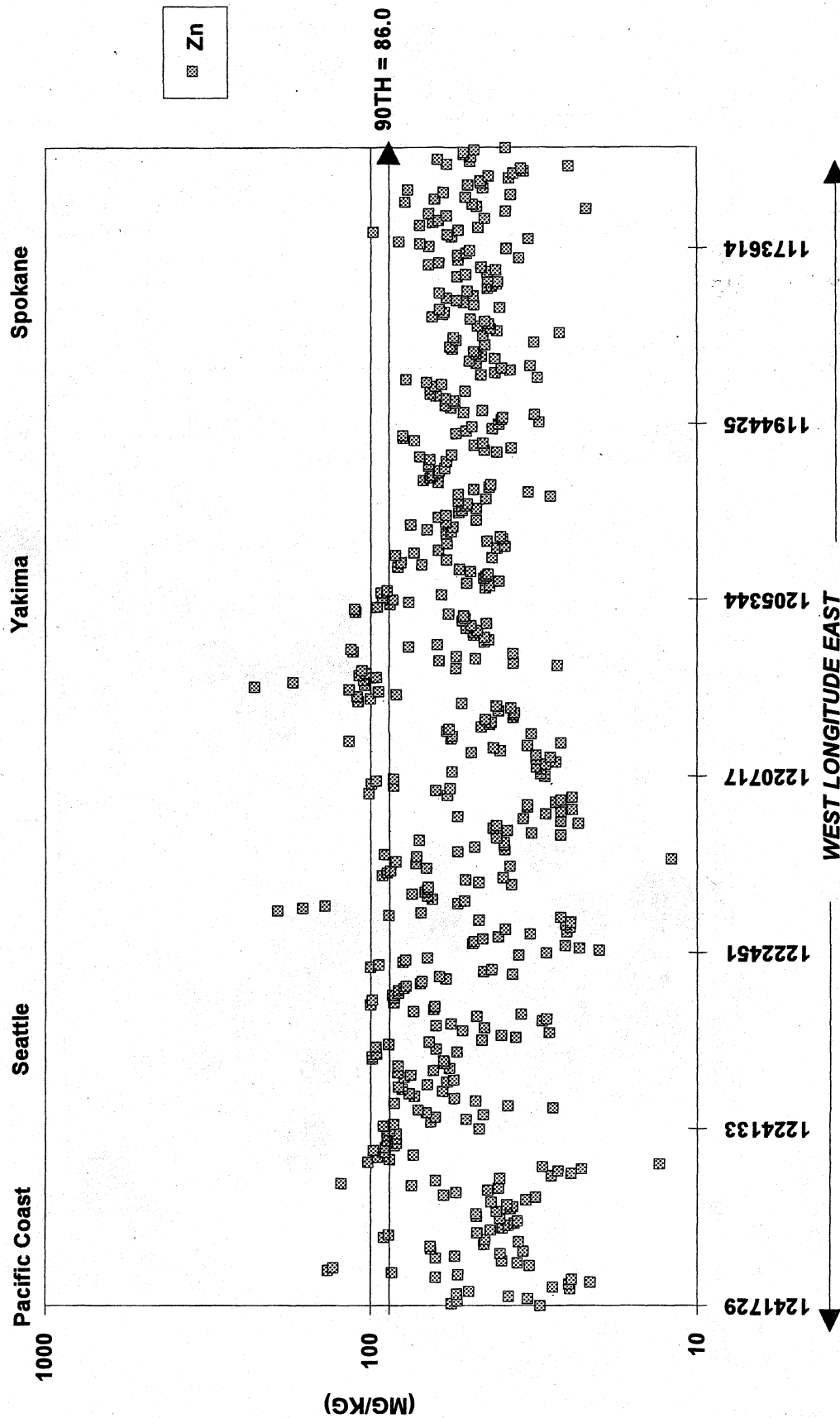
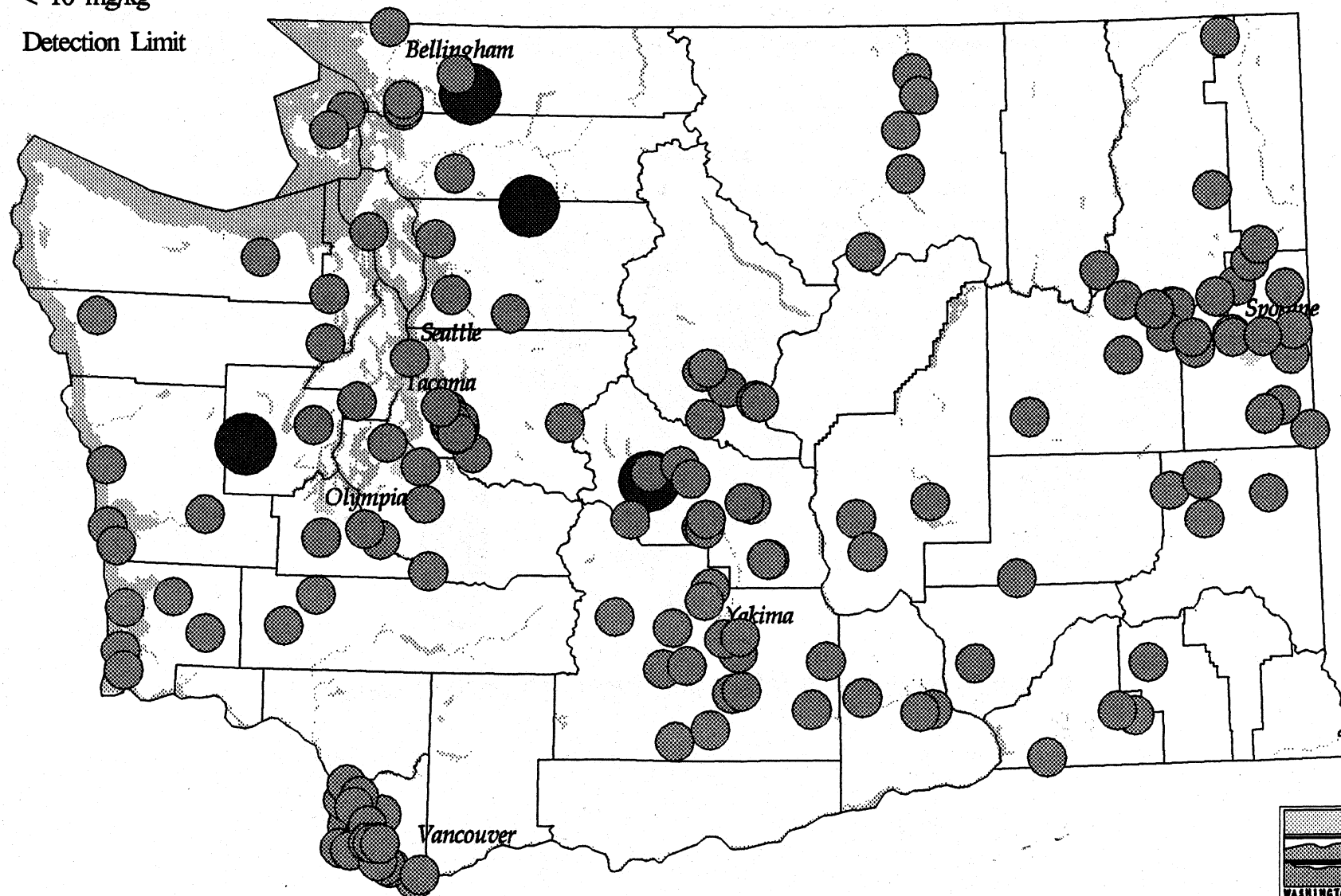
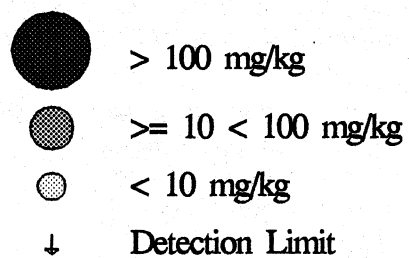


Figure 46: Zinc Concentrations



Map Prepared by EILS Program

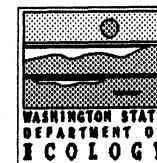
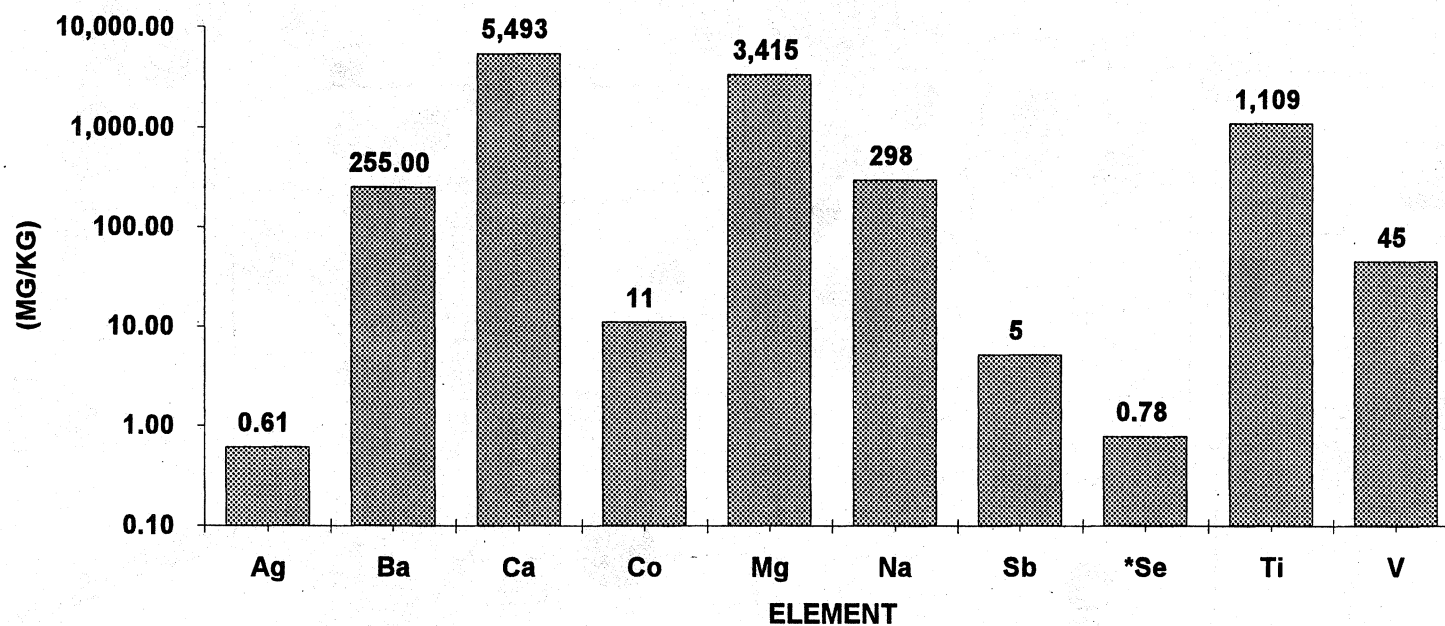


FIGURE 47: 90th PERCENTILE VALUES - OTHER ELEMENTS



	Ag	Ba	Ca	Co	Mg	Na	Sb	*Se	Ti	V
90th Percentile	0.61	255.00	5,493	11	3,415	298	5	0.78	1,109	45
Population (n)	33	72	72	72	72	69	50	14	72	72
Detection Limit	0.3						3	0.19		
Number > Detection Limit	33						50	14		

* Se 90th BASED ON ATOMIC ABSORPTION (AA) ANALYSIS.

Note: Ba, Ca, Co, Mg, Na, Ti, V data from Spokane Basin Only. Data may not be representative of statewide conditions.

X. DATA TABLES

Data Retrieval

All of the Manchester Laboratory analytical data for this project was obtained and retrieved electronically for QA/QC purposes. A data extraction program known as "Monarch" was then used to compile the data into spreadsheet form. Microsoft Excel was then used to compile all of the data into a spreadsheet format.

Interpreting the Data Tables

Two sets of data tables have been included. The first set contains values for Al - Fe. The second set contains data for Pb - Zn. All of the data table values are in units of parts per million or mg/kg. A brief description of each column in the data table is presented below.

Latitude and Longitude

Latitude and longitude coordinates have been assigned to all 166 sampling locations (first two columns, data tables).

Site Codes

The column entitled "Site" contains an alpha-numeric code for each sampling location. Each site code can be broken down into four parts: primary code, regional code, sample location number, and sample depth. Example site codes and their definitions are given in Table 14 below. Not every sample has all four parts; for example, samples collected in the 12-region study do not have a primary code. Several samples have a suffix with the letters "SS," "DUP," "V," or "RS." Definitions for these codes are given in Table 15.

Table 14: Site Code Definitions (read table left to right).

Site Code	Primary Code	Regional Code	Sample Location	Sample Depth
"SWRA2.5"	SW = Statewide	RA = Region "A"	N/A	2.5 = feet
"PSL2A0.5"	PSL = Puget Sound, Soos Creek	N/A	No. 2	0.5 = feet
"CL81.4V"	CL = Clark County	N/A	No. 8	1.4 = feet V = Vertical Profile Sample
"PS20.3"	PS = Puget Sound	N/A	No. 2	0.3 = feet
"SB310.3SS"	SB = Spokane Basin	N/A	No. 31	0.3 = feet "SS" = Sample Split
"YBRO2.5"	YB = Yakima Basin	RO = Region "O"	N/A	2.5 = feet

Table 15: Site Code Suffix Definition

Suffix	Definition
"V"	Vertical Profile Sample
"SS"	Sample Split
"DUP"	Duplicate Sample

Number Column

The Manchester sample number is given in this column. The first two digits give the year in which the sample was analyzed. The area in which a sample was collected can also be identified by sample number; i.e., all of the Soos Creek work was done in 1987, the 12-region study was completed in 1990, etc.(see Table 16 below)

Table 16: Background Soil Metals Study Chronology

Study	Completed In
Soos Creek	1987
Twelve Region	1990
Clark County	1991
Yakima Basin	1991
Spokane Basin	1992
Puget Sound Basin	1993

WASHINGTON BACKGROUND SOIL METALS DATA (Al - Fe)

LAT	LOX	SITE	NO.	Al	As	Ba	Cd	Cr	Cu	Fe
463937	1234536	SWRA2.5	90478080	53,500	4.55	0.46	<0.2	51.5	33.9	41,800
465952	1233542	SWRA2.5	90478081	50,500	3.48	0.44	<0.2	41.2	22.5	33,000
463110	1233352	SWRA2.5	90478082	51,500	1.9	0.71	<0.2	56.7	99.4	62,800
464120	1225527	SWRA2.3	90478083	28,800	1.8	0.65	<0.2	26	23.2	26,100
463337	1230623	SWRA2.3	90478084	37,800	8.12	0.89	<0.2	34.2	24.4	38,400
465553	1240957	SWRC2.5	90478086	7,070	2.9	0.1	<0.2	16	5.2	13,200
465125	1240634	SWRC2.6	90478087	7,450	2.8	0.13	<0.2	14.8	5.18	14,100
463628	1240232	SWRC2.6	90478088	6,020	1.8	0.1	<0.2	12.2	4.33	11,100
462602	1240317	SWRC2.5	90478089	5,670	1.7	0.1	<0.2	10.1	4.4	11,300
462116	1240157	SWRC2.5	90478090	6,680	2.32	0.1	<0.2	11.4	5.04	9,160
483954	1222930	SWRD2.3	90478092	21,700	2.8	0.29	<0.2	32	7.2	17,100
483908	1222926	SWRD2.3	90478093	16,600	1.9	0.4	<0.2	26.7	6.23	13,900
484152	1222929	SWRD2.6	90478094	16,400	2.6	0.26	<0.2	25.1	8.05	18,200
484809	1221033	SWRD2.7	90478095	25,100	4.65	0.6	<0.2	45.2	18.7	23,300
484332	1220527	SWRD2.5	90478096	46,100	8.99	0.61	<0.2	163	50.9	49,900
484833	1192416	SWRJ2.7	90478107	20,100	5.28	0.71	<0.2	35.9	53	27,700
483446	1192836	SWRJ3	90478108	13,000	1.1	0.33	<0.2	10.8	20.2	13,000
480522	1194153	SWRJ2.8	90478109	9,430	2.9	0.3	<0.2	17.9	11.6	15,500
482415	1192705	SWRJ3.2	90478110	8,130	1.1	0.26	<0.2	18.3	13.4	11,500
484313	1192153	SWRJ3	90478111	9,940	1.4	0.21	<0.2	11.4	11.9	10,400
473642	1204021	SWRL2.7	90478112	25,600	0.5	0.77	<0.2	71.3	27.3	26,200
473251	1203128	SWRL2.7	90478113	25,700	7.19	0.77	<0.2	36.9	28.7	25,000
473740	1203824	SWRL2.7	90478114	29,000	1.4	1.14	<0.2	29.3	14.8	20,200
472924	1202000	SWRL2.7	90478115	16,700	2.25	0.43	<0.2	20	14.7	19,100
472943	1202117	SWRL2.6	90478116	20,700	0.53	0.58	<0.2	38.4	16	22,900
470608	1175445	SWRP2.8	90478128	18,900	4.1	0.79	<0.2	15.4	21.9	30,000
465848	1174302	SWRP3	90478129	14,800	3.73	0.54	<0.2	12.6	16	24,700
462437	1180414	SWRP3	90478130	23,100	2.6	0.84	<0.2	16.1	18.9	26,100
461153	1180928	SWRP3	90478131	15,100	1.2	0.58	<0.2	6.1	11.1	11,200
461307	1181528	SWRP3.2	90478132	15,400	1.49	0.51	<0.2	7.6	12.9	13,200
470446	1191953	SWRR2.5	90478134	6,140	1.44	0.25	<0.2	5	9.1	21,300
470053	1194611	SWRR2.7	90478135	6,930	3.65	0.42	<0.2	6.6	13.2	23,500
464554	1184944	SWRR2.5	90478136	10,400	2.6	0.47	<0.2	10.8	14.6	17,100
465250	1194216	SWRR2.5	90478137	8,570	2.53	0.28	<0.2	8.8	12.7	16,200
462524	1190452	SWRR2.3	90478138	8,460	6.12	0.29	<0.2	9.1	13.2	22,200
454159	1223043	CL10.3	91238155	40,700		1.64	0.97	21.2	17.8	50,000
		CLR12.2	90478102	46,900	2.9	1.03	<0.2	27.5	26.2	55,700

ALL VALUES = MG/KG

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Al - Fe)

LAT	LONG	SITE	NO.	Al		As		Ba		Cd		Cr		Cu		Fe	
454014	1224057	CL20.3	91238156	22,500	20,150		1.5	1.09	0.75	0.77	0.485	15.6	16.75	12.5	13.95	36,600	33,350
		CLRG22.2	90478103	17,800		1.5		0.41		0.2		17.9		15.4		30,100	
454050	1224424	CL30.3	91238157	26,000	22,350		2.8	1.48	1.135	1.3	0.7	29.9	27.35	23.4	23.3	35,700	31,400
		CLRG32.2	90478104	18,700		2.8		0.79		<0.2		24.8		23.2		27,100	
454653	1223558	CL40.3	91238158	35,900	37,850		5.54	1.3	1.02	0.91	0.505	16.6	18.05	26.7	29.2	37,400	35,700
		CLRG42.2	90478105	39,800		5.54		0.74		<0.2		19.5		31.7		34,000	
454742	1224135	CL50.3	91238159	26,400	30,250		6.89	1.15	1	0.79	0.445	18.9	21.7	12.4	18.15	30,000	35,050
		CLRG52.2	90478106	34,100		6.89		0.85		<0.2		24.5		23.9		40,100	
455548	1224243	CL60.3	91238160	11,300	26,900			0.42	0.305	0.21	0.155	6.25	4.425	21.3	17	13,900	41,550
		CL62.2	91238161	42,500				0.19		<0.2		2.6		12.7		69,400	
455207	1224355	CL70.3	91238162	16,100	13,750	2.12	2.12	0.68	0.585	0.39	0.42	9.59	8.44	27.1	25.65	17,700	16,350
		CL72.2	91238163	11,400				0.49		0.45		7.29		24.2		15,000	
453343	1221828	CL80.3A	91238169	16,500	19,354		3.796	0.87	1.03077	1.1	0.95538	21.4	23.1154	20.8	23.3385	24,900	26,123
		CL80.3B	91238170	14,900				0.77		0.68		19.7		17.3		22,600	
		CL80.3C	91238173	17,800				0.93		1.9		21.3		28.2		27,000	
		CL80.3D	91238175	19,700				0.98		1.9		22.6		30.9		28,400	
		CL80.3V	91238164	21,000		5.65		1.05		1.4		21.9		25		26,100	
		CL80.8V	91238166	15,700		2.82		0.87		0.68		18.4		15.2		21,600	
		CL81.4V	91258511	14,800		2.70		0.78		0.55		19.2		17.3		21,200	
		CL82.2A	91238170	21,100				1.17		0.86		25.8		24.3		27,500	
		CL82.2B	91238172	22,400				1.19		0.78		28.3		25.7		29,900	
		CL82.2C	91238174	19,600				1.06		0.87		23.6		25.1		26,800	
		CL82.2D	91238176	20,700				1.16		0.42		26		24.9		27,600	
		CL82.2V	91238167	24,900		4.56		1.32		0.63		26.1		26.4		28,800	
		CL83.0V	91238168	22,500		3.25		1.25		0.65		26.2		22.3		27,200	
455053	1223856	CL90.3	91258512	33,300	25,500	6.74	5.195	1.36	1.09	0.7	0.62	22.4	18.75	54	39.25	36,600	29,300
		CL92.2	91258513	17,700		3.65		0.82		0.54		15.1		24.5		22,000	
455036	1223958	CL100.3	91238177	20,900	24,500			1.01	1.11	0.69	0.705	16	18.3	8.62	9.71	26,000	29,300
		CL102.2	91238178	28,700				1.21		0.72		20.6		10.8		32,600	
454614	1223507	CL110.3	91238179	31,400	31,400	2.85	3.08	1.32	1.36	0.72	0.715	23	23.9567	13.1	14.2333	30,600	32,733
		CL112.2	91238180	32,400		3.31		1.36		0.71		25.6		15.3		33,500	
		CL312.2.3SS	91258446	30,400				1.4		0.94		23.3		14.3		34,100	
454745	1223805	CL120.3	91238181	29,900	33,433	3.42	3.42	1.46	1.79	1.1	1.06	21.4	23.2667	13.7	25	30,300	42,200

ALL VALUES = MG/KG

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Al - Fe)

LAT	LONG	SITE	NO.	Al	As	Ba	Cd	Cr	Cu	Fe							
		CL120.08V	91238193	35,800		2.34	1.2	20.2	45.3	66,500							
		CL122.2	91238182	34,600		1.57	0.88	28.2	16	39,800							
454717	1223827	CL130.3	91238183	16,000	24,400	0.95	1.45	0.51	0.805	17	24.9	8.89	12.795	19,900	37,450		
		CL132.2	91238184	32,800		1.95		1.1	32.8			16.7		55,000			
453623	1222654	CL140.3	91238185	25,600	26,867	3.89	4.42	1.53	1.63667	0.6	0.83667	19.2	22.0667	22.9	30.9667	34,300	39,567
		CL280.3SS	91238209	25,400		4.95		1.57	1			21.1		56		39,200	
		CL142.2	91238186	29,600				1.81	0.91			25.9		14		45,200	
454222	1223140	CL150.3	91238187	53,500	43,000	2.64	2.995	1.9	1.74333	1.3	1.06	29	26.2333	22.2	20.7	48,800	45,633
		CL282.2SS	91238210	42,500		3.35		1.73		1.2		26		21.9		46,200	
		CL152.2	91238188	33,000				1.6		0.68		23.7		18		41,900	
454503	1223605	CL160.3	91238189	26,000	26,700			1.93	1.94	0.86	0.92	25.9	25.7	9.79	10.695	56,900	54,950
		CL162.2	91238190	27,400				1.95		0.98		25.5		11.6		53,000	
454552	1224208	CL170.3	91238191	28,800	30,300	3.16	3.67	1.48	1.475	0.82	0.74	19.9	20.95	11.7	11.95	31,300	33,250
		CL172.2	91238192	31,800		4.18		1.47		0.66		22		12.2		35,200	
453449	1221647	CL180.3	91258504	38,500	42,767	2.70	2.91333	1.44	1.49333	0.85	0.97	27.1	28.8333	16.6	17.5667	32,700	35,933
		CL182.2	91258505	45,100		3.14		1.52		1.1		30.5		18.2		37,500	
		CL292.2SS	91258510	44,700		2.90		1.49		0.96		28.9		17.9		37,600	
454854	1223018	CL190.08V	91238193	35,800	48,657		6.034	2.34	2.15571	1.2	1.29429	20.2	23.3714	45.3	51.7143	66,500	65,571
		CL190.3	91238197	49,100		5.56		1.93		1.1		20.7		44		40,400	
		CL190.3V	91238194	50,200				2.12		0.96		18.5		55.6		43,700	
		CL191.0V	91238212	51,000		4.09		2.45		1.4		24.8		54.8		59,000	
		CL191.6V	91238195	42,300		6.21		2.51		1.4		23.5		52.1		77,600	
		CL192.2	91238198	59,200		7.87		1.76		1.5		29.5		53.6		64,400	
		CL192.2V	91238196	53,000		6.44		1.98		1.5		26.4		56.6		67,400	
454442	1224133	CL200.3A	91238211	27,600	30,985	4.33	5.583	1.42	1.48385	1.1	0.93769	20.5	21.9154	12.3	15.8354	33,100	37,254
		CL200.3B	91258514	29,600		4.37		1.46		1.2		21.4		14.3		36,500	
		CL200.3C	91238201	26,200		4.50		1.29		1.1		18.4		13.6		31,300	
		CL200.3D	91238203	30,100		5.57		1.6		1.1		20.7		14.8		38,600	
		CL200.3V	91258500	28,800				1.49		0.66		20.3		13.8		32,400	
		CL200.8V	91258501	30,400				1.52		0.88		21		13.6		33,000	
		CL201.8A	91258518	33,000		6.29		1.56		1		23.5		14.1		41,600	
		CL201.8B	91258515	27,600		3.70		1.33		0.85		20.6		11.6		34,100	
		CL201.8C	91238202	30,900		5.51		1.46		0.93		22.1		15.8		38,100	
		CL201.8D	91258517	35,800		5.92		1.61		1.1		24.6		16		41,600	
		CL201.8V	91258502	19,000				0.9		0.57		12.7		8.86		21,200	
		CL203.0V	91258503	39,500		8.34		1.7		0.85		28.9		28.7		51,300	

ALL VALUES = MG/KG

10-5

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Al - Fe)

LAT	LONG	SITE	NO.	Al	As	Ba	Cd	Cr	Cu	Fe							
		CL205.1V	91238199	44,300	7.30	1.95	0.85	30.2	28.4	51,500							
455307	1223815	CL210.3	91238204	52,900	54,550	3.75	4.115	2.07	1.92	1.1	1.225	23.5	23.825	21	23.825	33,700	42,825
		CL212.2	91238205	69,800		4.48		2.09		1.5		28.7		24.5		43,500	
453958	1223100	CL220.3	91258506	48,300	48,900	1.60	1.45	1.8	1.8	1.8	1.53	1.1	1.1	5.65	21.5	21.4333	24.5
		CL222.2	91258507	47,200		1.30			1.72	1.72		1.2	1.2		21.5		25.2
453748	1223115	CL230.3	91258508	47,000	50,050	2.00	2.15	1.78	1.87	1.3	1.3	14.1	14.65	21.8	21.2	49,200	50,200
		CL232.2	91258509	53,100		2.30		1.96		1.3		15.2		20.6		51,200	
454215	1223453	CL240.3		38,800	41,800		3.01	1.8	1.72333	1.3	1.25	16.6	18.1	19.6	21.5667	52,900	53,933
		CL300.3SS	91258447	37,700				1.52		0.89		17.8		20		52,100	
		CL242.2	91238206	48,900		3.01		1.85		1.2		19.9		25.1		56,800	
454200	1223313	CL250.3	91238207	47,700	45,700	2.70	2.65	1.88	1.955	1.2	1.2	22	23.2	25.7	24.9	56,200	58,050
		CL252.2	91238208	43,700		2.60		2.03		1.2		24.4		24.1		59,900	
453654	1222824	CL260.3	91258516	46,100	48,500	1.90	2	1.85	1.99	1.1	1.1	14.8	16.45	24.1	25.4	56,900	59,850
		CL262.2	91258519	50,900		2.10		2.13		1.1		18.1		26.7		62,800	
		CL270.3RS	91258520	19,200	19,350	2.80	2.75	0.53	0.555	0.55	0.48	24.5	24.45	10	9.855	16,500	16,500
		CL272.2RS	91258521	19,500		2.70		0.58		0.41		24.4		9.71		16,500	
472129	1220717	PSL1A0.5	87278100	20,500	20,500							19	19	21	21	17,300	17,300
472256	1220642	PSL2A0.5	87278101	32,800	32,800			0.7	0.7	<.8	<.8	24	24	15	15		
472317	1220642	PSL3A0.1	87278104	25,900	21,820			0.6	0.53	<.8	0.4	22	22	13	17	16,100	15,560
		PSL3A0.5	87278105	22,800				0.6		<.8		19		18		15,300	
		PSL5AO.5DUP	87278102	21,800				0.6		<.8		19		27		17,000	
		PSL3A1.0	87278106	25,500				0.6		<.8		26		14		17,200	
		PSL3A4.0	87278107	13,100				<.5		<.8		25		13		12,700	
472407	1220657	PSL4A0.5	87278108	17,100	17,100			<.5	<.5	<.8	<.8	16	16	13	13	14,800	14,800
472410	1220657	PSL4B0.5	87278109	15,500	15,233			<.5	0.33333	<.8	2.93333	18	21	12	12	12,900	13,533
		PSL6A0.5	87278111	15,700				0.5		<.8		26		13		14,200	
		PSB8AO.5DUP	87278147	14,500				<.5		8		18		10		13,500	
472220	1220800	PSB1A0.5	87278112	23,800	23,800			0.7	0.7	<.8	<.8	24	24	14	14	20,100	20,100
472308	1221004	PSB2A0.5	87278113	21,900	22,450			0.7	0.75	<.8	<.8	24	23	13	12.5	17,000	17,000
		PSB6AO.5DUP	87278145	23,000				0.8		<.8		22		12		17,000	

ALL VALUES = MG/KG

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Al - Fe)

LAT	LONG	SITE	NO.	Al		As		Ba		Cd		Cr		Cu		Fe	
472404	1220945	PSB3A0.1	87278114	16,500	14,975			<.6	0.35	<.8	<.8	18	22	14	12	15,000	15,300
		PSB3A1.0	87278118	19,200				0.6		<.8		20		11		15,700	
		PSB3A3.0	87278123	13,900				<.5		<.8		25		11		15,000	
		PSB3A5.0	87278124	10,300				<.5		<.8		25		11		15,500	
472405	1220943	PSB3B0.1	87278128	13,200	13,675			<.5	0.3125	<.8	<.8	14	19	10	9	11,800	13,700
		PSB3B1.0	87278129	18,000				0.5		<.8		21		7		15,500	
		PSB3B2.0	87278130	13,300				<.5		<.8		20		11		13,300	
		PSB3B4.0	87278131	10,200				<.5		<.8		21		8		14,200	
472406	1220941	PSB3C0.1	87278132	10,900	12,175			<.5	<.5	<.8	<.8	14	20	14	14	11,900	12,950
		PSB3C2.0	87278133	14,900				<.5		<.8		23		9		13,900	
		PSB3C4.0	87278134	12,700				<.5		<.8		25		22		13,300	
		PSB3C5.0	87278135	10,200				<.5		<.8		19		10		12,700	
472405	1220942	PSB3D1.0	87278136	16,900	16,900			<.5	<.5	<.8	<.8	22	22	10	10	14,900	14,900
472404	1220944	PSB3E1.0	87278139	21,700	21,700			<.6	<.6	<.8	<.8	20	20	12	12	16,800	16,800
472508	1220914	PSB4A0.1	87278140	14,900	19,160			<.5	0.37	<.8	0.4	25	24	14	11	14,000	12,320
		PSB4A0.5	87278141	15,000				<.5		<.8		26		12		14,000	
		PSB4A2.0	87278142	28,300				0.6		<.8		24		8		11,300	
		PSB7A2.0DUP	87278146	25,000				0.5		<.8		20		8		10,300	
		PSB4A4.0	87278143	12,600				<.5		<.8		27		12		12,000	
472653	1221116	PSB5A0.5	87278144	7,390	7,390			<0.5	<0.5	<0.8	<0.8	12	12	4	4	5,920	5,920
472143	1220734	PSSD1A	87278148	13,200	13,200			<.5	<.5	5	5	19	19	14	14	17,900	17,900
472129	1220742	PSSD1B	87278149	11,800	11,600			<.5	<.5	<.8	<.8	20	19.5	24	18	14,800	16,350
		PSSD1C	87278150	11,400				<.5		<.8		19		12		17,900	
472131	1220725	PSSD2A	87278151	13,300	12,850			<.5	<.5	2	1.2	28	21.5	24	21	17,300	17,100
		PSSD2B	87278152	12,400				<.5		<.8		15		18		16,900	
472112	1220742	PSSD3A	87278153	12,600	14,150			<.5	0.375	<.8	0.7	23	22.5	18	25	18,100	19,450
		PSSD3B	87278154	15,700				0.5		1		22		32		20,800	
483845	1225008	PS10.3	93088519	24,000	20,800	6.64	5.818	0.71	0.544	0.55	0.424	34.1	35.3	32.1	29.24	28,700	29,040
		PS300.3DUP	93088637	21,000		5.72		0.66		<0.2		31.2		28.8		27,400	
		PS12.2	93088520	21,700		6.29		0.42		0.55		36.3		29.8		27,300	
		PS302.2DUP	93088638	16,700		5.99		0.44		<0.2		33.4		25.4		25,500	
		PS155	93088521	20,600		4.45		0.49		0.82		41.5		30.1		36,300	

ALL VALUES = MG/KG

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Al - Fe)

LAT	LOH	SITE	NO.	Al		As		Be		Cd		Cr		Cu		Fe	
483355	1225604	PS20.3	93088522	14,600	14,175	2.79	3.735	0.37	0.37	0.37	0.34	19.6	22.625	15.5	14.075	17,700	20,525
		PS270.3DUP	93088631	13,400		2.3		0.36		<0.2		17.9		15		15,800	
		PS22.2	93088523	17,300		6		0.38		0.55		30.8		15.5		28,200	
		PS272.2DUP	93088632	11,400		3.85		0.23		<0.2		22.2		10.3		20,400	
485910	1223507	PS30.3	93088524	22,900	20,057	4.58	4.25	0.38	0.36667	0.78	0.56667	29.2	31.3	13.6	13.8667	22,500	21,433
		PS32.2	93088525	22,700		4.48		0.39		0.62		38.6		16.6		23,100	
		PS355	93088526	14,600		3.69		0.33		0.3		26.1		11.4		18,700	
481630	1214308	PS40.3V	93088527	20,600	21,936	9.07	9.39786	0.28	0.32	1.1	0.83143	47.8	49.1214	39.5	42.8429	36,600	37,757
		PS320.3SS	93088641	19,700		10.2		0.27		0.26		45.1		38.8		33,400	
		PS41.0V	93088528	21,100		8.3		0.32		0.59		46.2		33.5		37,400	
		PS42.2V	93088529	20,300		7.56		0.3		1.4		44.6		42.9		32,100	
		PS43.0V	93088530	21,100		7.91		0.33		0.67		47.6		44.6		36,500	
		PS44.9V	93088531	26,200		14.1		0.37		1.1		59.2		51.2		47,400	
		PS40.3A	93088532	21,500		10.5		0.33		0.92		47.7		38.2		36,600	
		PS40.3B	93088533	23,000		9.43		0.33		1		50.6		45.4		38,100	
		PS40.3C	93088534	19,800		8.66		0.28		1		42.8		41.8		35,500	
		PS40.3D	93088535	18,200		8.16		0.27		0.77		40.8		28.5		35,200	
		PS42.2A	93088536	22,300		8.35		0.34		0.65		50.1		48.6		37,900	
		PS42.2B	93088537	25,700		10.8		0.36		0.8		59		59.8		42,600	
		PS42.2C	93088538	25,000		8.77		0.38		0.67		54.2		40.3		40,900	
		PS42.2D	93088539	22,600		9.76		0.32		0.71		52		46.7		38,400	
480938	1224043	PS50.3	93088540	12,000	12,400	2.32	2.215	0.22	0.23	0.37	0.38	21.4	22	12.7	11.235	15,800	16,550
		PS51.5	93088541	12,800		2.11		0.24		0.39		22.6		9.77		17,300	
480239	1231923	PS60.3	93088542	10,000	10,713	1.18	1.61667	0.24	0.25333	0.28	0.30333	14	15.3667	6.78	8.97333	11,400	14,333
		PS62.2	93088543	12,600		1.11		0.29		0.3		15.5		8.04		12,200	
		PS655	93088544	9,540		2.56		0.23		0.33		19.6		12.1		19,400	
471643	1220203	PS70.3V	93088545	13,300	11,580	5.57	4.27429	0.38	0.29143	0.47	0.35571	22.6	18.7429	21.4	16.1071	20,700	18,079
		PS71.4V	93088546	15,600		5.82		0.39		0.55		14.4		20.7		25,300	
		PS72.2V	93088547	8,660		2.56		0.24		0.26		16.1		12.6		12,500	
		PS73.0V	93088548	16,300		6.51		0.39		0.49		14.2		19.6		27,600	
		PS73.8V	93088549	16,000		5.68		0.38		0.58		15.9		19.3		24,900	
		PS70.3A	93088550	10,500		3.93		0.19		0.57		20.2		16.7		15,900	
		PS70.3B	93088551	10,600		3.84		0.26		0.41		17.1		12.2		15,300	
		PS70.3C	93088552	10,400		4.44		0.28		0.21		18.9		16.2		16,400	
		PS310.3SS	93088639	10,300		4.54		0.25		<0.2		20.3		17.7		15,900	
		PS70.3D	93088553	8,860		3.75		0.23		0.27		20		10.6		13,200	
		PS72.2A	93088554	10,900		3.3		0.27		0.34		23.1		14.4		16,600	
		PS72.2B	93088555	10,100		2.77		0.27		0.29		18.3		14.1		15,300	

ALL VALUES = MG/KG

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Al - Fe)

LAT	LONG	SITE	NO.	Al	As	Ba	Be	Cd	Cr	Cu	Fe						
		PS72.2C	93088556	11,700	4.06	0.3	0.48	22.2	16.1	17,500							
		PS72.2D	93088557	10,300	3.07	0.25	<0.2	19.1	13.9	16,000							
475035	1214917	PS80.3	93088558	18,000	21,400	11.3	8.615	0.26	0.33	0.46	0.28	38.9	41.95	18.6	19.5	24,600	25,850
		PS82.2	93088559	24,800	5.93	0.4	<0.2	45	20.4	27,100							
474226	1225456	PS90.3	93088560	28,300	32,300	1.81	1.665	0.44	0.47	<0.2	<0.2	43.9	48.75	49.7	64.55	37,100	40,400
		PS91	93088561	36,300	1.52	0.5	<0.2	53.6	79.4	43,700							
475420	1225412	PS100.3	93088562	13,300	13,850	3.74	2.99	0.23	0.23	<0.2	<0.2	21.3	21.15	8.03	7.59	12,900	13,050
		PS102.2	93088563	14,400	2.24	0.23	<0.2	21	7.15	13,200							
471843	1223157	PS110.3V	93088564	14,800	16,540	11.2	17.1685	0.27	0.26615	0.21	0.45846	19.1	24.3538	20.6	32.0308	10,900	13,354
		PS111.4V	93088565	18,600	11.6	0.32	0.33	25	18.9	13,800							
		PS112.2V	93088566	20,500	2.46	0.29	<0.2	29.6	13.9	16,600							
		PS113.0V	93088567	23,000	9.34	0.29	0.44	30.7	22	18,000							
		PS114.0V	93088568	14,700	5.04	0.26	<0.2	22	16.7	11,700							
		PS110.3A	93088569	8,820	73.3	0.14	2.6	11.8	111	7,400							
		PS110.3B	93088570	17,600	19.3	0.31	0.37	25	23	16,100							
		PS110.3C	93088571	14,400	50.7	0.22	0.82	29.4	101	11,400							
		PS110.3D	93088572	14,000	23.5	0.23	0.59	19	34.7	10,700							
		PS112.2A	93088573	16,800	3.94	0.27	<0.2	23.2	12.6	12,000							
		PS112.2B	93088574	14,600	3.75	0.22	<0.2	21.7	11.1	12,400							
		PS112.2C	93088575	20,400	6.04	0.33	<0.2	29.8	19.1	15,900							
		PS112.2D	93088576	16,800	3.02	0.31	<0.2	30.3	11.8	16,700							
472827	1224307	PS120.3	93088577	15,800	16,367	2.52	1.99333	0.27	0.27	<0.2	<0.2	16.2	21.7	6.78	8.84667	13,700	14,300
		PS122.2	93088578	18,800	1.66	0.27	<0.2	24	10.7	16,200							
		PS292.2SS	93088636	14,500	1.8	0.26	<0.2	24.9	9.06	13,000							
471723	1232215	PS130.3	93088579	82,100	84,900	2.2	2.35	0.86	0.875	<0.2	0.19	45.3	47.25	231	243.5	109,000	112,500
		PS132.2	93088580	87,700	2.5	0.89	0.28	49.2	256	116,000							
472232	1225818	PS140.3	93088581	19,900	17,900	2.5	1.8	0.29	0.25667	<0.2	<0.2	23.4	28.2	16.5	19.1667	19,200	18,200
		PS141.5	93088582	21,300	1.5	0.26	<0.2	26.7	20.4	18,800							
		PS1455	93088583	12,500	1.4	0.22	<0.2	34.5	20.6	16,600							
465504	1225420	PS150.3V	93088584	25,500	23,193	3.36	3.81929	0.48	0.41	<0.2	0.1	18.9	18.3429	16.9	18.0429	17,700	17,793
		PS151.2V	93088585	26,900	2.8	0.46	<0.2	17.7	19.5	18,300							
		PS152.2V	93088586	24,400	2.7	0.43	<0.2	19.5	18.7	18,000							
		PS153.0V	93088587	21,300	2.5	0.34	<0.2	18.2	18.8	18,000							
		PS154.3V	93088588	17,300	2.5	0.3	<0.2	15.9	18.6	18,000							
		PS312.2SS	93088640	18,400	2.3	0.4	<0.2	18	17.8	18,200							
		PS150.3A	93088589	24,100	3.18	0.39	<0.2	18.1	17.1	17,900							

ALL VALUES = MG/KG

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Al - Fe)

LAT	LOH	SITE	NO.	Al	As	Ba	Cd	Cr	Cu	Fe							
		PS150.3B	93088590	24,500	4.27	0.43	<0.2	17	16.4	16,900							
		PS150.3C	93088591	23,900	4.28	0.43	<0.2	17.2	16.3	17,200							
		PS150.3D	93088592	23,700	3.7	0.46	<0.2	16	17.6	18,000							
		PS152.2A	93088593	22,800	2.1	0.37	<0.2	20.1	17.7	17,400							
		PS152.2B	93088594	22,200	8.75	0.39	<0.2	19.1	19.7	17,200							
		PS152.2C	93088595	23,300	8.63	0.41	<0.2	22.1	17.6	17,300							
		PS152.2D	93088596	26,400	2.4	0.45	<0.2	19	19.9	19,000							
480812	1221653	PS160.3	93088597	16,000	17,450	2.3	2.3	0.25	0.27	<0.2	<0.2	18	22.6	10.2	11.85	15,200	15,550
		PS161.2	93088598	18,900		2.3		0.29		<0.2		27.2		13.5		16,900	
471307	1222000	PS170.3	93088599	10,900	10,360	3.25	2.535	0.33	0.305	<0.2	<0.2	14.6	14.25	37.9	29.65	13,700	13,450
		PS172.2	93088600	9,820		1.82		0.28		<0.2		13.9		21.4		13,200	
471055	1241132	PS180.3	93088601	17,900	20,675	2.84	2.86	0.28	0.3225	<0.2	<0.2	43.2	33.225	25	25.3	39,300	34,500
		PS182.2	93088602	27,000		3.04		0.39		<0.2		45.2		40.5		45,700	
		PS282.2SS	93088634	23,400		3.89		0.25		<0.2		22.8		13.7		27,800	
		PS1855	93088603	14,400		1.67		0.37		<0.2		21.7		22		25,200	
474657	1241729	PS190.3	93088604	18,800	20,125	2.54	2.935	0.13	0.29667	<0.2	<0.2	17	21.225	8.43	14.6825	24,400	25,675
		PS192.2	93088605	23,900		3.64		0.42		<0.2		23.4		14.6		29,300	
		PS1955	93088606	15,200		2.01		0.34		<0.2		16.2		9.64		24,900	
473919	1222451	PS200.3V	93088607	12,000	12,462	6.29	4.326	0.23	0.24333	<0.2	0.14	16.4	19.92	10.2	10.8493	10,700	11,700
		PS200.8V	93088608	13,500		2.14		0.26		<0.2		16.7		6.86		11,300	
		PS202.2V	93088609	11,500		1		0.23		<0.2		16.9		8.13		10,200	
		PS203.0V	93088610	9,310		1.4		0.19		<0.2		18.3		8.46		10,700	
		PS204.5V	93088611	9,620		1.51		0.24		<0.2		20.1		8.98		11,700	
		PS200.3A	93088612	12,900		13.5		0.27		0.34		24.1		16		12,300	
		PS290.3SS	93088635	13,300		6.38		0.27		0.32		19.3		15.2		11,400	
		PS200.3B	93088613	13,100		10.5		0.25		0.24		20		14.5		11,200	
		PS200.3C	93088614	14,500		7.9		0.29		<0.2		18.3		12.6		11,200	
		PS200.3D	93088615	11,500		4.02		0.23		<0.2		20.1		10.4		10,800	
		PS202.2A	93088616	15,700		2.06		0.29		<0.2		27.4		9.45		13,800	
		PS280.3SS	93088633	11,100		3.11		0.21		<0.2		22.4		15.1		16,000	
		PS202.2B	93088617	13,300		1.58		0.24		<0.2		21		8.88		11,500	
		PS202.2C	93088618	12,600		1.4		0.21		<0.2		20.4		8.98		11,900	
		PS202.2D	93088619	13,000		2.1		0.24		<0.2		17.4		9		10,800	
470353	1221824	PS210.3	93088620	25,500	31,800	4.46	2.83	0.57	0.7	<0.2	<0.2	9.97	16.385	11.7	20.3	16,000	20,500
		PSWRF2.7	90478097	38,100		1.2		0.83		<0.2		22.8		28.9		25,000	
465501	1223333	PS220.3	93088621	28,700	34,450	2.3	2.145	0.59	0.565	<0.2	<0.2	10	17.55	16.4	20.65	13,300	17,650
		PSWRF2.5	90478098	40,200		1.99		0.74		<0.2		25.1		24.9		22,000	

ALL VALUES = MG/KG

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Al - Fe)

LAT	LOn	SITE	NO.	Al		As		Be		Cd		Cl		Cu		Fe	
465728	1223904	PS230.3	93088622	16,200	22,400	2	1.975	0.36	0.415	<0.2	<0.2	13.3	19.95	10.3	14.3	12,000	16,700
		PSWRF2.5	90478099	28,600		1.95		0.47		<0.2		26.6		18.3		21,400	
475451	1221040	PS240.3	93088623	20,000	24,800	6.29	5.585	0.45	0.53	0.21	0.155	35.8	47.75	18.7	24.9	23,700	27,750
		PSWRF2.5	90478100	29,600		4.88		0.61		<0.2		59.7		31.1		31,800	
482413	1221025	PS250.3	93088624	13,500	18,750	4.26	4.215	0.15	0.185	<0.2	<0.2	157	235	13.1	19.8	23,000	27,500
		PSWRF2.7	90478101	24,000		4.17		0.22		<0.2		313		26.5		32,000	
464743	1221631	PSLB10.3	93088625	14,400	13,700	2	2.15	0.37	0.395	<0.2	<0.2	15.4	17.95	21.1	17.5	13,200	15,150
		PSLB12.2	93088626	13,000		2.3		0.42		<0.2		20.5		14.1		17,100	
472742	1221326	PSLB20.3	93088627	33,000	39,300	1.1	1.45	0.54	0.61	<0.2	<0.2	63.2	79.05	71.3	86.65	44,200	52,550
		PSLB22.2	93088628	45,600		1.8		0.68		<0.2		94.9		102		60,900	
460223	1184019	PS260.3RS	93088629	9,330	8,970	3.79	3.57	0.43	0.435	<0.2	<0.2	9.35	9.11	16.5	16.35	21,900	21,650
		PS262.2RS	93088630	8,610		3.35		0.44		<0.2		8.87		16.2		21,400	
472457	1184356	SB10.3	92268500	9,070	8,934	3.59	4.0275	0.36	0.3775	0.51	0.465	6.87	6.5675	14	14.4	15,700	18,400
		SB330.3SS	92268574	9,570		3.15		0.38		0.43		7.45		13.1		16,500	
		SB12.2	92268501	7,940		5.22		0.35		0.37		5.73		15.1		19,400	
		SB320.3SS	92268573	9,155		4.15		0.42		0.55		6.22		15.4		22,000	
473910	1180946	SB20.3	92268502	15,800	15,700	3.92	5.11333	0.61	0.66333	0.46	0.45333	7.47	8.95333	14.9	14.9333	14,600	16,133
		SB340.3SS	92268575	17,100		3.72		0.66		0.38		7.79		14.4		15,400	
		SB22.2	92268503	14,200		7.70		0.72		0.52		11.6		15.5		18,400	
475026	1175046	SB30.3	92268504	13,500	14,675	6.17	7.9475	0.64	0.6675	0.55	0.54	7.48	9.235	12.8	15.025	19,000	20,800
		SB32.2	92268505	14,500		9.87		0.68		0.66		9.93		14.1		22,900	
		SB270.3 SS	92268568	17,600		9.92		0.73		0.59		11		14.8		24,500	
		SB3SSBD	92268506	13,100		5.83		0.62		0.36		8.53		22.4		16,800	
470819	1174318	SB40.3	92268507	13,000	12,850	2.55	2.515	0.52	0.535	0.51	0.645	12.9	13.05	15.2	14.45	16,200	16,100
		SB41.2	92268508	12,700		2.48		0.55		0.78		13.2		13.7		16,000	
474232	1173037	SB50.3	92268509	13,300	13,650	3.82	4.305	0.64	0.655	0.76	0.685	9.87	10.535	9.82	10.95	27,200	27,000
		SB51.3	92268510	14,000		4.79		0.67		0.61		11.2		12.1		26,800	
480033	1172325	SB60.3	92268511	12,200	10,623	3.21	3.485	0.54	0.505	0.47	0.3125	10.9	11.5	7.32	7.415	13,200	12,518
		SB290.3SS	92268570	14,500		3.03		0.62		0.22		11.2		8.15		14,300	
		SB62.2	92268512	9,680		3.90		0.48		0.46		12.1		8.89		13,400	
		SB6SS	92268513	6,110		3.80		0.38		<0.2		12.2		5.3		9,170	

ALL VALUES = MG/KG

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Al - Fe)

LAT	LONG	SITE	NO.	Al	As	Ba	Be	Cd	Co	Cu	Fe	Pb	Mn	Ni	Sb	Se	Si	Te	Zn
481824	1173603	SB70.3	92268514	30,100	20,537	2.10	1.13667	0.95	0.72333	1	0.65333	10.5	10.9767	30.2	29.0333	22,700	24,100		
		SB71.8	92268515	22,100		0.71		0.88		0.73		14.8		38.6		35,600			
		SB7SS	92268516	9,410		0.60		0.34		0.23		7.63		18.3		14,000			
475949	1181738	SB80.3	92268517	15,500	15,067	5.82	6.45333	0.62	0.58667	0.82	0.87667	11.2	12.0333	11.6	11.4667	13,400	13,967		
		SB310.3SS	92268572	16,000		5.90		0.56		0.79		10.7		11.8		13,400			
		SB82.2	92268518	13,700		7.64		0.58		0.42		14.2		11		15,100			
485517	1173112	SB90.3	92268519	14,300	12,603	3.10	2.74	0.55	0.47667	0.7	0.62667	11.8	11.0533	15.9	14.1433	20,500	18,400		
		SB91.4	92268520	15,300		3.32		0.55		0.69		13.4		17.2		20,300			
		SB9SBD	92268521	8,210		1.80		0.33		0.49		7.96		9.33		14,400			
480433	1171952	SB100.3	92268522	26,600	25,850	5.74	6.41	0.84	0.825	0.61	0.535	11.3	11.85	13.9	13.5	16,500	17,000		
		SB102.2	92268523	25,100		7.08		0.81		0.46		12.4		13.1		17,500			
474434	1175413	SB110.3	92268524	19,100	16,975	5.92	6.9275	0.72	0.6825	0.66	0.57	14.8	13.025	34.2	25.725	23,000	25,300		
		SB111.3	92268525	18,800		7.95		0.74		0.57		13.1		18.8		37,800			
		SB350.3SS	92268576	15,900		8.27		0.7		0.65		13.1		35.6		20,200			
		SB11SBD	92268526	14,100		5.57		0.57		0.4		11.1		14.3		20,200			
474018	1174407	SB120.3	92268527	18,700	19,950	3.05	3.845	0.73	0.785	0.45	0.41	14.7	16.95	16.8	17.3	17,900	19,500		
		SB122.2	92268528	21,200		4.24		0.84		0.37		19.2		17.8		21,100			
471929	1170403	SB130.3	92268529	24,200	21,275	3.46	3.45	0.88	0.82	0.62	0.4625	19.2	18.775	17.2	16.3	22,300	21,225		
		SB300.3SS	92268571	23,900		2.30		0.88		0.41		18.3		16.8		21,800			
		SB132.2	92268530	20,400		4.35		0.85		0.36		22.9		18.1		23,900			
		SB13SBD	92268531	16,600		3.69		0.67		0.46		14.7		13.1		16,900			
472534	1171355	SB140.3	92268532	16,500	15,363	2.10	2.3	0.63	0.62625	0.25	0.34	14	12.3375	14.4	15.8625	16,000	14,663		
		SB142.2	92268533	19,900		2.60		0.71		0.36		13.7		17.4		17,600			
		SB140.3V	92268534	17,000		1.70		0.62		0.36		13.6		14.4		15,800			
		SB140.8V	92268535	14,800		2.80		0.66		0.41		12.4		15		15,300			
		SB142.2V	92268536	13,800		2.30		0.62		0.29		10.9		16.5		13,100			
		SB280.3SS	92268569	14,800		2.40		0.66		0.4		11.4		16.8		14,200			
		SB143.7V	92268537	13,300		2.40		0.56		0.34		11.2		16.9		12,900			
		SB145.0V	92268538	12,800		2.10		0.55		0.31		11.5		15.5		12,400			
470433	1171952	SB150.3	92268539	15,500	14,550	2.70	3.3	0.74	0.75	0.33	0.36	14.5	16	13.5	13.35	16,300	17,050		
		SB152.2	92268540	13,600		3.90		0.76		0.39		17.5		13.2		17,800			
472343	1172004	SB160.3	92268541	21,200	23,650	2.70	2.75	0.78	0.875	0.29	0.395	20.2	20.25	17.7	18.25	23,300	24,750		
		SB162.2	92268542	26,100		2.80		0.97		0.5		20.3		18.8		26,200			
474257	1174500	SB170.3	92268543	17,100	16,500	6.66	8.53	0.65	0.67	0.39	0.37	12.2	12.7	17.8	17.3	20,200	21,100		

ALL VALUES = MG/KG

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Al - Fe)

LAT	LONG	SITE	NO.	Al	As	Be	Cd	Cr	Cu	Fe							
		SB172.2	92268544	15,900	10.40	0.69	0.35	13.2	16.8	22,000							
474346	1170832	SB180.3	92268545	20,100	17,000	6.57	8.635	0.64	0.605	0.41	0.4	9.18	9.94	11.8	11.85	17,000	18,150
		SB182.2	92268546	13,900		10.70		0.57		0.39		10.7		11.9		19,300	
476233	1173614	SB190.3V	92268547	16,900	13,235	8.16	10.3257	0.68	0.63643	0.3	0.33857	11.2	11.7885	11.7	13.3071	17,600	16,736
		SB191.2V	92268548	15,700		10.30		0.67		0.51		11.8		12.5		18,100	
		SB192.2V	92268549	11,500		11.90		0.57		0.42		12.9		13		17,800	
		SB193.6V	92268550	11,700		16.60		0.61		0.34		14.6		17.2		19,200	
		SB194.4V	92268551	13,200		14.20		0.63		0.44		13.5		15.9		19,100	
		SB190.3A	92268552	16,700		6.89		0.68		0.37		11.6		12.4		18,100	
		SB192.2A	92268553	18,400		9.02		0.74		0.83		12.4		13.8		19,200	
		SB190.3B	92268554	14,600		7.89		0.69		<0.3		11		13.5		15,800	
		SB192.2B	92268555	7,880		10.10		0.5		<0.3		10.5		12.1		13,200	
		SB190.3C	92268556	14,400		8.16		0.71		<0.3		11.1		12.9		15,800	
		SB192.2C	92268557	12,400		18.20		0.66		0.32		13.6		17.2		17,800	
		SB190.3D	92268558	13,900		7.07		0.66		0.46		10.3		10.6		14,700	
		SB192.2D	92268559	8,990		12.40		0.51		<0.3		11.6		10.5		14,400	
		SB19.SS	92268560	9,020		3.67		0.6		<0.3		8.94		13		13,500	
474232	1171937	SB200.3	92268561	17,100	19,450	2.70	2.55	0.79	0.82	0.3	0.375	7.62	6.31	6.86	5.415	20,900	24,550
		SB202.2	92268562	21,800		2.40		0.85		0.45		5		3.97		28,400	
473743	1171000	SB210.3	92268563	11,900	12,650	6.62	8.01	0.58	0.54	0.33	0.215	10.9	11.65	11.4	13	21,200	22,300
		SBRU2.3	90478140	13,400		9.4		0.5		<0.2		12.4		14.6		23,400	
474313	1173053	SB220.3	92268564	19,100	19,850	4.72	5.25	0.83	0.72	0.33	0.215	12.7	14.4	16.4	19.95	18,700	20,000
		SBRU2.5	90478141	20,600		5.8		0.61		<0.2		16.1		23.5		21,300	
475037	1175147	SB230.3	92268565	12,000	14,150	4.29	4.995	0.62	0.55	0.3	0.2	10.8	13.25	11.1	14.45	13,900	17,550
		SBRU2.8	90478142	16,300		5.7		0.48		<0.2		15.7		17.8		21,200	
475002	1175805	SB240.3	92268566	10,800	12,050	8.04	8.42	0.51	0.495	<0.3	0.125	10	11.45	12	13.05	16,200	18,150
		SBRU2.6	90478143	13,300		8.8		0.48		<0.2		12.9		14.1		20,100	
476232	1180911	SB250.3	92268567	10,800	12,500	5.55	5.55	0.51	0.515	<0.3	0.125	10.6	12.85	10.9	12.95	14,100	15,600
		SBRU2.6	90478144	14,200				0.52		<0.2		15.1		15		19,100	
476453	1172838	SB380.3	92268577	17,400	15,000	4.75	5.415	0.62	0.58	0.27	0.185	10.9	10.65	11	10.8	14,800	14,300
		SB382.2	92268578	12,600		6.08		0.54		<0.2		10.4		10.6		13,800	
476349	1171054	SB390.3	92268579	14,400	13,100	1.40	1.45	0.94	0.89	0.26	0.18	4.5	4.5	3.9	4.045	10,300	9,670
		SB391.5	92268580	11,800		1.50		0.84		<0.2		4.5		4.19		9,040	

ALL VALUES = MG/KG

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Al - Fe)

LAT	LO	SITE	NO.	Al	As	Ag	Be	Bi	Cd	Cr	Cu	Fe					
463437	1205022	YB10.3	91258554	13,500	13,500	0.9	0.89	1.15	1.15	0.46	0.46	13.3	13.3	13.3	13.3	32,600	32,600
463222	1202650	YB20.3	91258556	15,300	15,300	2.5	2.5	0.82	0.82	0.61	0.61	15	15	19.6	19.6	27,800	27,800
463153	1203223	YB30.3	91258558	19,700	19,700	1.8	1.8	0.95	0.95	0.72	0.72	14.3	14.3	17.7	17.7	29,000	29,000
462623	1195653	YB40.3	91258559	19,000	19,300	2.6	2.995	0.88	0.905	0.23	0.405	17	18.5	17.9	18.75	27,300	28,300
		YB42.2	91258560	19,600		3.4		0.93		0.58		20		19.6		29,300	
461355	1192417	YB50.3A	91258566	13,600	14,886	5.1	7.62571	0.84	0.92071	0.71	0.62929	12	13.1571	18.2	19.6357	25,100	28,643
		YB50.3B	91258568	12,500		3.5		0.77		0.52		11.4		12.9		23,200	
		YB50.3C	91258537	15,800		9.1		0.93		0.44		11.5		20.7		28,100	
		YB50.3D	91258539	15,200		6.5		0.91		0.45		12.2		20.7		29,900	
		YB50.3V	91258574	14,200		4.6		0.82		0.44		12.7		18.4		25,400	
		YB340.3SS	91258582	13,700		4.4		0.81		0.76		13.1		17.7		25,100	
		YB50.7V	91258575	16,100		5.1		0.89		0.58		13.4		19.9		28,200	
		YB51.3V	91258576	17,100		7.8		0.98		0.75		16.1		24.4		29,800	
		YB52.2A	91258567	15,700		10.9		1.05		1.1		13.3		21		34,300	
		YB52.2B	91258564	13,400		5.4		0.84		0.67		14.2		17.3		26,500	
		YB52.2C	91258538	14,100		11.5		1.07		0.52		12.3		20.1		34,000	
		YB52.2D	91258540	14,000		9.9		1.03		0.73		11.6		19.5		32,600	
		YB52.2V	91258577	16,000		11.2		0.94		0.57		13.9		23		27,600	
		YB53.2V	91258565	17,000		11.6		1.01		0.57		16.5		21.1		31,200	
461445	1200151	YB60.3	91258562	23,000	27,800	5.4	4.82	1.05	1.15667	0.49	0.66	29.3	31.6	23	27.0667	35,600	39,600
		YB332.2SS	91258569	26,000		5.4		1.09		0.58		31.8		23.6		37,400	
		YB62.2	91258563	34,400		3.7		1.33		0.91		33.7		34.6		45,800	
460709	1204921	YB70.3	91258421	47,100	55,550			2.25	2.79	0.95	1.275	6.54	7.57	20.8	24.6	42,800	53,800
		YB72.2	91258422	66,000				3.33		1.6		8.8		28.4		64,800	
460959	1203706	YB80.3	91258423	23,000	26,667			1.13	1.31	0.85	0.67667	14.9	18.6333	17.9	20.1333	28,800	33,567
		YB362.2	91258429	23,100				1.13		0.58		16		18		29,100	
		YB81.8	91258424	33,900				1.67		0.6		25		24.5		42,800	
461920	1202619	YB90.3A	91258571	20,900	21,914	2.4	2.43	1.04	1.04429	0.62	0.66571	10.7	12.0029	21	18.6143	30,700	30,936
		YB90.3B	91258573	23,100		1.4		1.22		0.57		12.4		20.1		34,000	
		YB90.3C	91258578	23,700		1.7		1.26		0.8		12.6		17.2		34,900	
		YB342.2SS	91258583	23,500		1.8		1.26		1.4		11.2		17.6		34,900	
		YB90.3D	91258581	24,700		2.2		1.2		0.94		12		18.2		36,900	
		YB90.3V	91258417	18,800				0.95		0.35		9.98		18.9		27,600	
		YB90.7V	91258418	12,400				0.58		0.6		3.6		13.2		14,900	
		YB92.2A	91258572	27,200		3.2		1.18		0.8		16		17.9		36,500	
		YB92.2B	91258580	18,000		3.4		0.76		0.5		8.5		11.9		20,900	

ALL VALUES = MG/KG

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Al - Fe)

LAT	LO	SITE	NO	Al		As		Be		Cd		Cr		Cu		Fe	
		YB92.2C	91258579	23,900		2.4		0.97		0.49		12.9		17		31,100	
		YB92.2D	91258541	20,500		2.9		0.94		0.43		9.46		15.5		27,800	
		YB92.2V	91258419	21,100				0.9		<0.2		11		16.3		26,100	
		YB93.5V	91258420	26,600				1.18		1		18.4		31.5		36,200	
		YB95.0V	91258570	22,400		2.9		1.18		0.72		19.3		24.3		40,600	
462827	1202727	YB100.3	91258542	20,200	21,950	3.1	3.475	0.96	1.085	0.46	0.63	15.8	16.7	22.9	25.15	31,200	33,100
		YB102.2	91258543	23,700		3.9		1.21		0.8		17.6		27.4		35,000	
464415	1203715	YB110.3	91258544	21,000	23,000	1.5	1.5	0.69	0.78	0.37	0.48333	11.4	11.7333	17.2	27.0333	20,900	21,633
		YB360.3SS	91258412	24,200				0.85		0.35		11.5		19.7		22,000	
		YB112.2	91258411	23,800				0.8		0.73		12.3		44.2		22,000	
471215	1205848	YB12.2	91258555	17,100	32,579	0.6	3.858	1.4	1.07571	0.56	0.50071	14	46.0286	14	18.55	39,800	27,071
		YB120.3A	91258430	31,600		4.1		0.96		0.22		36.9		18.1		23,700	
		YB120.3B	91258432	29,400		4.1		0.9		0.43		36.5		15.8		21,900	
		YB120.3C	91258413	25,400		3.6		0.78		0.44		29.6		16.7		18,800	
		YB120.3D	91258415	31,600		4.5		0.95		0.42		33.9		18.9		22,800	
		YB120.3V	91258425	33,600				1.09		0.55		33		20.2		22,300	
		YB120.7V	91258426	35,900				1.15		0.72		38.4		19.5		25,700	
		YB121.0V	91258427	40,300				1.23		0.83		46		21.6		26,700	
		YB122.2A	91258431	34,800		4.6		1.06		0.3		53.1		17.3		28,100	
		YB122.2B	91258433	32,600		4.0		1.01		0.46		46.3		16.7		26,100	
		YB122.2C	91258414	34,300		4.4		1.06		<0.2		76.8		18.8		29,400	
		YB122.2D	91258416	36,100		4.6		1.12		0.68		47		19		28,000	
		YB122.2V	91258428	40,400				1.31		0.74		48.9		20.5		28,500	
		YB123.2V	91258526	33,000		4.1		1.04		0.56		104		22.6		37,200	
471015	1205856	YB130.3	91258404	28,100	29,600		2.9	0.98	1.03667	0.77	0.8	27.4	31.4667	16.4	21.0333	27,100	30,600
		YB350.3SS	91258408	26,100		2.9		0.89		0.86		27.1		16.9		27,200	
		YB132.2	91258405	34,600				1.24		0.77		39.9		29.8		37,500	
470505	1202520	YB140.2	91258524	24,400	20,750	1.3	1.34286	1.2	1.4175	0.59	0.8425	19.6	16.35	18.7	17.1625	35,100	39,663
		YB140.2V	91258545	20,800		1.7		1.46		1.3		17.9		18.8		40,500	
		YB140.6V	91258546	18,400		1.5		1.38		0.72		15.4		17.1		38,000	
		YB330.3SS	91258551	18,400		1.3		1.42		0.97		14.8		16.4		35,900	
		YB141.0	91258523	25,400				1.52		0.72		19.5		18.2		42,300	
		YB141.0V	91258547	20,300		1.3		1.38		0.81		15.1		16.3		39,800	
		YB141.7V	91258548	20,400		1.2		1.59		0.85		15.8		17		43,800	
		YB142.5V	91258525	17,900		1.1		1.39		0.78		12.7		14.8		41,900	
465850	1204027	YB150.3	91258549	25,100	27,200	1.9	1.8	1.21	1.245	0.64	0.87	21.9	22	17.2	18.1	30,400	31,550
		YB151.6	91258550	29,300		1.7		1.28		1.1		22.1		19		32,900	

ALL VALUES = MG/KG

10-15

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Al - Fe)

LAT	LOH	SITE	NO.	Al		As		Be		Cd		Cr		Cu		Fe	
471047	1204419	YB160.3	91258406	24,200	23,233	3.12	2.5	0.98	0.98	0.51	0.4	28.9	30.3	18.5	17.1333	20,400	22,033
		YB352.2SS	91258409	19,800		2.1		0.88		<0.2		27.8		16.1		20,000	
		YB162.2	91258407	25,700		2.9		1.08		0.59		34.2		16.8		25,700	
471407	1204807	YB170.3	91258552	14,800	16,450	2.5	2.815	0.72	0.72	0.58	0.515	34.3	37.85	11.3	12.4	20,000	21,350
		YB172.1	91258553	18,100		3.1		0.72		0.45		41.4		13.5		22,700	
463713	1211038	YB180.3	91258528	19,600	20,850	2.0	2.3	0.69	0.77	0.49	0.525	9.27	12.135	13.2	17.75	14,800	17,200
		YB182.2	91258527	22,100		2.6		0.85		0.56		15		22.3		19,600	
462441	1205344	YB190.3	91258403	34,600	41,400		1.83333	1.49	1.97	1.12	1.32857	13.4	18.2286	19.6	22.8	39,700	58,800
		YB190.3V	91258529	37,900		1.4		1.59		1.2		14		22.9		46,800	
		YB190.7V	91258530	39,600		1.8		1.84		1		15.9		20.7		52,800	
		YB191.2V	91258400	43,700		1.8		2.27		1.6		22.2		23.1		68,400	
		YB192.2	91258410	38,000		1.7		1.8		0.98		18.2		21.8		48,300	
		YB192.2V	91258401	50,500		2.2		2.49		1.9		23.1		24.9		80,500	
		YB194.0V	91258402	45,500		2.1		2.31		1.5		20.8		26.6		75,100	
470048	1210530	YB200.3	91258533	10,900	10,650	2.1	1.95	0.45	0.39	0.36	0.35	2.41	2.555	4.31	4.125	5,600	5,025
		YB201.0	91258534	10,400		1.8		0.33		0.34		2.7		3.94		4,450	
472528	1203915	YB210.3	91258535	23,400	24,550	38.1	28.6	0.79	0.83	0.5	0.655	128	110.3	43.7	50.15	36,400	35,450
		YB210.8	91258536	25,700		19.1		0.87		0.83		92.6		56.6		34,500	
472417	1212858	YB22.2	91258557	17,600	20,133	2.6	2.91667	0.94	0.7	0.36	0.37	21.1	12.96	19.4	15.2333	29,800	20,733
		YB220.3	91258531	15,700		3.8		0.47		0.34		6.88		15.6		13,300	
		YB222.0	91258532	27,100		2.3		0.69		0.41		10.9		10.7		19,100	
461432	1191954	YB230.3	91258439	12,400	11,700	3.6	3.685	0.77	0.65	0.27	0.185	11.4	11.6	14.6	16.2	23,500	22,750
		YBRO2.5	90478123	11,000		3.8		0.53		<0.2		11.8		17.8		22,000	
461727	1194425	YB240.3	91258440	15,500	14,600	5.2	5.33	0.89	0.73	0.45	0.275	17	17.15	21.8	20.5	25,300	23,150
		YBRO2.5	90478124	13,700		5.5		0.57		<0.2		17.3		19.2		21,000	
462522	1204526	YB250.3	91258441	19,100	16,900	2.5	3.05	0.99	0.805	0.54	0.32	15.8	15.85	18.7	18.55	26,400	24,550
		YBRO2.5	90478125	14,700		3.6		0.62		<0.2		15.9		18.4		22,700	
461843	1202937	YB260.3	91258442	18,800	15,450	4.4	4.695	1.11	0.89	0.56	0.33	15.7	14.3	21.1	21.3	33,100	30,350
		YBRO2.3	90478126	12,100		5		0.67		<0.2		12.9		21.5		27,600	
464114	1203916	YB270.3	91258443	19,200	15,600	3.5	3.365	0.86	0.635	0.63	0.365	16.4	15.55	19.9	20.1	29,900	26,900
		YBRO2.2	90478127	12,000		3.2		0.41		<0.2		14.7		20.3		23,900	
470433	1202247	YB280.3	91258435	22,200	25,300	1.0	0.96	1.36	1.38	0.8	0.45	12.1	16.8	16.1	18.85	37,700	44,700

ALL VALUES = MG/KG

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Al - Fe)

LAT	LO	SITE	NO.	Al		As		Ba		Cd		Cr		Cu		Fe	
		YBRM2.5	90478118	28,400		0.97		1.4		<0.2		21.5		21.6		51,700	
465846	1203919	YB290.3	91258436	24,300	24,900	1.4	1.245	1.34	1.21	0.64	0.37	39.6	38.45	20.1	23.5	40,200	41,700
		YBRM2.6	90478119	25,500		1.09		1.08		<0.2		37.3		26.9		43,200	
465114	1201724	YB300.3	91258437	21,500	18,750	2.2	2.58	0.96	0.815	0.21	0.155	15.9	16.5	17.1	21.5	25,200	23,900
		YBRM2.6	90478120	16,000		2.96		0.67		<0.2		17.1		25.9		22,600	
465112	1201624	YB310.3	91258438	14,500	17,000	1.3	1.65	0.94	0.89	0.42	0.26	11.3	13.15	12.8	16.4	27,500	30,050
		YBRM2.6	90478121	19,500		2.0		0.84		<0.2		15		20		32,600	
470058	1203855	YB32.2	91258561	29,800	24,267	3.4	2.515	1.44	1.04667	0.75	0.35	18.6	21.2333	30.8	22.3333	406	15,369
		YB320.3	91258434	17,400		1.6		0.92		0.2		19		15.5		21,800	
		YBRM2.3	90478122	25,600		2.0		0.78		<0.2		26.1		20.7		26,900	
		YB370.3RS	91258444	18,100	18,800	2.7	2.7	0.54	0.555	0.39	0.4	25.1	25.85	9.3	9.545	16,000	15,450
		YB372.2RS	91258445	19,500		2.7		0.57		0.41		26.6		9.79		16,900	

ALL VALUES = MG/KG

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Pb - Zn)

LAT	LONG	SITE	NO.	Pb	Mn	Hg	Ni	Zn					
463937	1234536	SWRA2.5	90478080	12	537	0.119	26.8	63.1					
465952	1233542	SWRA2.5	90478081	9.7	303	0.093	19.6	53.8					
463110	1233352	SWRA2.5	90478082	4	930	0.055	63.2	86					
464120	1225527	SWRA2.3	90478083	4	277	0.042	11.9	44.5					
463337	1230623	SWRA2.3	90478084	10	633	0.061	14.2	63					
465553	1240957	SWRC2.5	90478086	3.2	159	0.009	10.3	24.4					
465125	1240634	SWRC2.6	90478087	2.3	149	0.01	10	27.5					
463628	1240232	SWRC2.6	90478088	2.1	107	0.011	9	21.1					
462602	1240317	SWRC2.5	90478089	3.1	112	0.011	8.7	24.6					
462116	1240157	SWRC2.5	90478090	2.3	78	0.009	7.6	24.1					
483954	1222930	SWRD2.3	90478092	5.2	229	0.021	22.3	36.7					
483908	1222926	SWRD2.3	90478093	6.1	197	0.038	31.3	42.4					
484152	1222929	SWRD2.6	90478094	3.8	231	0.031	19.1	45					
484809	1221033	SWRD2.7	90478095	4.7	366	0.045	39.8	54					
484332	1220527	SWRD2.5	90478096	12	631	0.185	91.1	116					
484833	1192416	SWRJ2.7	90478107	9.9	571	0.025	24.6	77.9					
483446	1192836	SWRJ3	90478108	5.4	345	0.01	7.8	39.4					
480522	1194153	SWRJ2.8	90478109	6.6	256	0.004	12.3	39.6					
482415	1192705	SWRJ3.2	90478110	4.8	234	0.007	17	31.4					
484313	1192153	SWRJ3	90478111	4.2	233	0.013	9.5	30.7					
473642	1204021	SWRL2.7	90478112	5	363	0.005	34.1	82.3					
473251	1203128	SWRL2.7	90478113	9.5	430	0.015	20.8	75.4					
473740	1203824	SWRL2.7	90478114	8.8	294	0.01	16.7	58.3					
472924	1202000	SWRL2.7	90478115	6.4	340	0.013	12.2	41					
472943	1202117	SWRL2.6	90478116	5.9	372	0.004	19.4	56.4					
470608	1175445	SWRP2.8	90478128	11.7	652	0.021	16.5	49.4					
465848	1174302	SWRP3	90478129	8	516	0.008	10.7	43.8					
462437	1180414	SWRP3	90478130	10.4	523	0.004	14	47.1					
461153	1180928	SWRP3	90478131	6.7	252	0.011	7.7	26.3					
461307	1181528	SWRP3.2	90478132	5.8	279	0.004	7.1	31.5					
470446	1191953	SWRR2.5	90478134	4.2	245	0.004	6.4	37.4					
470053	1194811	SWRR2.7	90478135	8	378	0.004	9.2	42.2					
464554	1184944	SWRR2.5	90478136	6.8	325	0.004	11.2	32.4					
465250	1194216	SWRR2.5	90478137	6	268	0.004	9.7	30.3					
462524	1190452	SWRR2.3	90478138	5.3	377	0.01	11.7	39.7					
454159	1223043	CL10.3	91238155	6.7	984	0.022	17.7	85.5					
		CLRG12.2	90478102	9.9	825	0.019	20.4	82.1					

ALL VALUES = MG/KG

10-18

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Pb - Zn)

LAT	LONG	SITE	NO.	Pb		Mn		Hg		Ni		Zn	
454014	1224057	CL20.3	91238156	5.9	5.45	857	667.5	0.024	0.021	19.2	19.3	65.2	58
		CLRG22.2	90478103	5		478		0.018		19.4		50.8	
454050	1224424	CL30.3	91238157	14	11.3	837	665.5	0.038	0.0315	25.1	22.85	123	93
		CLRG32.2	90478104	8.6		494		0.025		20.6		63	
454653	1223558	CL40.3	91238158	6.7	7.7	1010	848	0.043	0.0425	12	12.55	78.9	77.1
		CLRG42.2	90478105	8.7		686		0.042		13.3		75.3	
454742	1224135	CL50.3	91238159	12	12.5	1210	927	0.041	0.0455	14.9	15.2	95	84.5
		CLRG52.2	90478106	13		644		0.05		17.5		74	
455548	1224243	CL60.3	91238160	<2	<2	230	150	0.025	0.01375	8	7	29.7	21.4
		CL62.2	91238161	<2		70		<0.005		6		13.1	
455207	1224355	CL70.3	91238162	6	4.65	256	231.5	0.033	0.031	10.1	9.35	40.1	33.95
		CL72.2	91238163	3.3		207		0.029		8.6		27.8	
453343	1221828	CL80.3A	91238169	13	12.04385	412	420.7692	0.041	0.047931	19.5	20.26923	88	89.51538
		CL80.3B	91238170	10		344		0.029		17.5		70.1	
		CL80.3C	91238173	30		485		0.03		18.3		193	
		CL80.3D	91238175	21.1		521		0.04		20		162	
		CL80.3V	91238164	17.8		450		0.04		20.7		138	
		CL80.8V	91238166	5.8		306		0.024		17		54.1	
		CL81.4V	91258511	6.9		307		0.025		17.6		51.5	
		CL82.2A	91238170	7.7		452		0.0706		22		64.4	
		CL82.2B	91238172	8		463		0.0749		22.9		66.7	
		CL82.2C	91238174	10		414		0.07		20.9		74.8	
		CL82.2D	91238176	8.3		483		0.08		22.3		68.1	
		CL82.2V	91238167	10.5		425		0.0696		22.8		66.6	
		CL83.0V	91238168	7.47		408		0.029		22		66.4	
455053	1223856	CL90.3	91258512	14	9.8	726	509.5	0.038	0.0285	15.6	12.75	84.7	66.15
		CL92.2	91258513	5.6		293		0.019		9.9		47.6	
455036	1223958	CL100.3	91238177	8	7.3	1180	926.5	0.03	0.035	10.6	12.6	67.4	59.45
		CL102.2	91238178	6.6		673		0.04		14.6		71.5	
454614	1223507	CL110.3	91238179	10.4	9.185	1100	829.8667	0.04	0.03	17.2	16.26667	82.4	67.86667
		CL112.2	91238180	7.97		562		0.02		16.5		64	
		CL312.2.3SS	91258446	3.6		827		0.026		15.1		57.2	
454745	1223805	CL120.3	91238181	14	12.23333	1688	1836	0.04	0.026667	16.5	14.3	80.1	76.4

ALL VALUES = MG/KG

10-19

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Pb - Zn)

LAT	LONG	SITE	NO	Pb		Mn		Hg		Ni		Zn	
		CL120.08V	91238193	13		2610		0.02		10.4		82.2	
		CL122.2	91238182	9.7		1210		0.02		16		66.9	
454717	1223827	CL130.3	91238183	9.5	8.65	365	807.5	0.03	0.02	7.9	12	55.3	64.3
		CL132.2	91238184	7.8		1250		0.01		16.1		73.3	
453623	1222654	CL140.3	91238185	54	29.6	536	659	0.04	0.021667	12.4	13.76667	79.6	74.9
		CL280.3SS	91238209	24.8		529		0.005		13.4		78.1	
		CL142.2	91238186	10		912		0.02		15.5		67	
454222	1223140	CL150.3	91238187	10.4	8.733333	434	464.6667	0.03	0.033333	21	15.96667	73.9	67.1
		CL282.2SS	91238210	8.1		420		0.04		14.3		63.9	
		CL152.2	91238188	7.7		540		0.03		12.6		63.5	
454503	1223605	CL160.3	91238189	6.8	5.5	1030	1110	0.05	0.04	13	13.55	58.2	55.85
		CL162.2	91238190	4.2		1190		0.03		14.1		55.5	
454552	1224208	CL170.3	91238191	16.3	13.7	2140	1525.5	0.03	0.02	117	66.75	102	94.75
		CL172.2	91238192	11.1		911		0.01		16.5		87.5	
453449	1221647	CL180.3	91258504	13.9	10.73333	1770	1483.333	0.039	0.031	17.6	18.83333	92.1	89.33333
		CL182.2	91258505	11		1370		0.027		19		89	
		CL292.2SS	91258510	7.3		1310		0.027		19.9		86.9	
454854	1223018	CL190.08V	91238193	13	10.77143	2610	1960.867	0.02	0.02	10.4	14.32867	82.2	71.38571
		CL190.3	91238197	14.2		1100		0.02		15.6		79.1	
		CL190.3V	91238194	14.1		1870		0.03		12		78	
		CL191.0V	91238212	9.2		1850		0.035		13.4		70.4	
		CL191.6V	91238195	7.6		4060		0.01		14.3		69.7	
		CL192.2	91238198	9.6		616		0.005		20.4		58.8	
		CL192.2V	91238196	7.7		1620		0.02		14.2		61.5	
454442	1224133	CL200.3A	91238211	11	11.09	1610	1192.164	0.025	0.025846	16.3	16.46164	90.1	84.68462
		CL200.3B	91258514	12		1430		0.033		16.5		98.1	
		CL200.3C	91238201	11		1670		0.03		15.7		89.7	
		CL200.3D	91238203	10		1730		0.02		16.6		84.5	
		CL200.3V	91258500	14.5		1430		0.033		15.6		83.3	
		CL200.8V	91258501	12.7		1330		0.024		15		89	
		CL201.8A	91258518	9.2		1240		0.028		16.3		83.8	
		CL201.8B	91258515	8.1		1300		0.016		14.1		88.9	
		CL201.8C	91238202	11		1040		0.02		17.4		83.5	
		CL201.8D	91258517	10		743		0.025		16.7		87.4	
		CL201.8V	91258502	6.27		387		0.028		9.9		46.3	
		CL203.0V	91258503	16		804		0.034		22.4		91.3	

ALL VALUES = MG/KG

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Pb - Zn)

LAT	LONG	SITE	NO.	Pb		Mn		Hg		Ni		Zn	
		CL205.1V	91238199	12.4		784		0.02		21.5		85	
455307	1223815	CL210.3	91238204	16	15.975	1640	1077.25	0.02	0.0285	15	18.9	76.1	79.9
		CL212.2	91238205	14		639		0.03		18.2		60.1	
453958	1223100	CL220.3	91258506	19	15	1160	983.75	0.033	0.0255	20.8	17.975	98.8	92.1
		CL222.2	91258507	15		870		0.031		21.6		84.6	
453748	1223115	CL230.3	91258508	18	12.9	963	952.5	0.029	0.0192	13.8	14.75	100	92.5
		CL232.2	91258509	7.8		942		0.0094		15.7		85	
454215	1223453	CL240.3		9.6	9.1	986	1042	0.037	0.0205	19	18.5	98.6	97.7
		CL300.3SS	91258447	8.8		1100		0.03		17		98.8	
		CL242.2	91238206	8.9		1040		0.004		19.5		95.7	
454200	1223313	CL250.3	91238207	7.8	7.45	989	902.5	0.02	0.0125	17.6	19	96.4	92.2
		CL252.2	91238208	7.1		816		0.005		20.4		88	
453654	1222824	CL260.3	91258516	8.7	6.7	928	951	0.029	0.022	17.7	17.4	100	97.3
		CL262.2	91258519	4.7		974		0.015		17.1		94.6	
		CL270.3RS	91258520	4.7	4.15	258	252.5	0.046	0.0465	26.1	13.0735	29.1	29.55
		CL272.2RS	91258521	3.6		247		0.047		0.047		30	
472129	1220717	PSL1A0.5	87278100	29	29	846	846	0.06	0.06	22	22	56	56
472256	1220642	PSL2A0.5	87278101	<4	<4	163	163	0.047	0.047	22	22	31	31
472317	1220642	PSL3A0.1	87278104	<4	<4	420	310	0.027	0.0292	25	23	49	38
		PSL3A0.5	87278105	<4		373		0.036		21		40	
		PSL5AO.5DUP	87278102	<4		412		0.035		21		42	
		PSL3A1.0	87278106	<4		163		0.036		27		33	
		PSL3A4.0	87278107	<4		184		0.012		22		26	
472407	1220657	PSL4A0.5	87278108	<4	<4	299	299	0.042	0.042	18	18	29	29
472410	1220657	PSL4B0.5	87278109	<4	<4	239	228	0.052	0.033	20	22	27	29
		PSL6A0.5	87278111	<4		231		0.02		25		31	
		PSB8AO.5DUP	87278147	<4		215		0.027		22		28	
472220	1220800	PSB1A0.5	87278112	<4	<4	763	763	0.052	0.052	34	34	58	58
472308	1221004	PSB2A0.5	87278113	<4	<4	494	374.5	0.058	0.052	23	23	39	39
		PSB6AO.5DUP	87278145	<4		255		0.046		23		39	

ALL VALUES = MG/KG

10-21

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Pb - Zn)

LAT	LONG	SITE	NO.	Pb		Mn		Hg		Ni		Zn	
472404	1220945	PSB3A0.1	87278114	<5	2.125	916	499	0.058	0.0445	24	27	71	43
		PSB3A1.0	87278118	<4		595		0.042		28		41	
		PSB3A3.0	87278123	<4		161		0.051		25		26	
		PSB3A5.0	87278124	<4		324		0.027		29		32	
472405	1220943	PSB3B0.1	87278128	<4	<4	562	302	0.052	0.02775	17	22	42	33
		PSB3B1.0	87278129	<4		291		0.028		28		41	
		PSB3B2.0	87278130	<4		138		0.012		21		23	
		PSB3B4.0	87278131	<4		218		0.019		22		26	
472406	1220941	PSB3C0.1	87278132	15	5.25	1,310	474	0.058	0.03325	16	23	54	33
		PSB3C2.0	87278133	<4		232		0.035		24		29	
		PSB3C4.0	87278134	<4		141		0.02		24		26	
		PSB3C5.0	87278135	<4		212		0.02		27		24	
472405	1220942	PSB3D1.0	87278136	<4	<4	321	321	0.028	0.028	24	24	34	34
472404	1220944	PSB3E1.0	87278139	<4	<4	738	738	0.058	0.058	25	25	38	38
472508	1220914	PSB4A0.1	87278140	<4	<4	143	141	0.043	0.0355	17	17	33	29
		PSB4A0.5	87278141	<4		164		0.043		17		33	
		PSB4A2.0	87278142	<4		137		0.04		19		27	
		PSB7A2.0DUP	87278146	<4		122		0.041		16		26	
		PSB4A4.0	87278143	<4		141		0.011		16		24	
472653	1221116	PSB5A0.5	87278144	<4	<4	90	90	0.012	0.012	9	9	12	12
472143	1220734	PSSSED1A	87278148	<4	<4	2,750	2750	0.076	0.076	16	16	99	99
472129	1220742	PSSSED1B	87278149	397	207.5	367	815.5	0.037	0.036	22	21.5	101	82
		PSSSED1C	87278150	18		1,270		0.035		21		63	
472131	1220725	PSSSED2A	87278151	<4	<4	721	607	0.035	0.027	23	23	96	90.5
		PSSSED2B	87278152	<4		493		0.019		23		85	
472112	1220742	PSSSED3A	87278153	<4	<4	1,090	2170	0.023	0.0475	25	25	57	71
		PSSSED3B	87278154	<4		3,250		0.072		25		85	
483845	1225008	PS10.3	93088519	16	10.25	1210	951.5	0.0726	0.04974	29.8	36.85	59.6	54.6
		PS300.3DUP	93088637	13		1090		0.0671		25.3		54.6	
		PS12.2	93088520	5.8		819		0.046		30		43.6	
		PS302.2DUP	93088638	5.5		972		0.04		22.8		40.5	

ALL VALUES = MG/KG

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Pb - Zn)

LAT	LOX	SITE	NO.	Pb		Mn		Hg		Ni		Zn	
		PS155	93088521	11		667		0.023		76.4		74.7	
483355	1225604	PS20.3	93088522	6.5	6.033333	654	523	0.039	0.029	21.3	18.7	65.1	62.575
		PS270.3DUP	93088631	6.3		637		0.029		17.5		65.4	
		PS22.2	93088523	5.3		459		0.019		22.7		44.7	
		PS272.2DUP	93088632	4.2		342		0.015		13.3		35.1	
485910	1223507	PS30.3	93088524	10	6.866667	538	509.6667	0.043	0.037333	25.9	24.66667	82.5	67.16667
		PS32.2	93088525	5.2		298		0.043		28.5		59.4	
		PS355	93088526	5.4		693		0.026		19.6		59.6	
481630	1214308	PS40.3V	93088527	18	29.47857	663	659.9286	0.0712	0.094407	53.7	54.68671	109	116.75
		PS320.3SS	93088641	16		586		0.0665		48.4		100	
		PS41.0V	93088528	12		854		0.0571		51.8		110	
		PS42.2V	93088529	20		484		0.195		62.5		83.3	
		PS43.0V	93088530	9.4		520		0.143		58.9		94.5	
		PS44.9V	93088531	13		513		0.109		62.3		116	
		PS40.3A	93088532	61.3		819		0.044		51.8		227	
		PS40.3B	93088533	16		660		0.0986		54.1		104	
		PS40.3C	93088534	182		673		0.0928		48.1		173	
		PS40.3D	93088535	14		934		0.0521		39.9		105	
		PS42.2A	93088536	12		506		0.114		59.6		95.7	
		PS42.2B	93088537	14		611		0.106		59.1		108	
		PS42.2C	93088538	14		793		0.0829		53.8		103	
		PS42.2D	93088539	11		623		0.0895		61.6		106	
480938	1224043	PS50.3	93088540	6.7	5.9	804	557.5	0.036	0.0285	24.1	25.8	63.2	54.15
		PS51.5	93088541	5.1		311		0.021		27.5		45.1	
480239	1231923	PS60.3	93088542	6.7	5.133333	471	561	0.044	0.03	14	17.06667	32.5	35.8
		PS62.2	93088543	3.8		314		0.027		17.5		35.4	
		PS655	93088544	4.9		898		0.019		19.7		39.5	
471643	1220203	PS70.3V	93088545	14	5.521429	422	350.5714	0.0616	0.043457	22.3	18.17143	56.6	44.5
		PS71.4V	93088546	5.3		485		0.0506		14.3		56	
		PS72.2V	93088547	3.2		319		0.021		17.6		32.1	
		PS73.0V	93088548	4.3		429		0.0523		14		58.3	
		PS73.8V	93088549	7.3		438		0.0532		14.8		57.3	
		PS70.3A	93088550	9.1		366		0.0591		19.4		45.6	
		PS70.3B	93088551	9		379		0.0565		16.4		43.1	
		PS70.3C	93088552	8.2		315		0.0591		17.5		42.6	
		PS310.3SS	93088639	9.9		316		0.044		16.8		44.5	
		PS70.3D	93088553	6.4		251		0.032		18.3		36.5	
		PS72.2A	93088554	3.4		262		0.026		22.8		36.4	

ALL VALUES = MG/KG

10-23

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Pb - Zn)

LAT	LONG	SITE	NO	Pb	Mn	Hg	Ni	Zn					
		PS72.2B	93088555	3.2	247	0.027	19.3	36.2					
		PS72.2C	93088556	4.6	353	0.032	21.4	40.6					
		PS72.2D	93088557	3.4	326	0.034	19.5	37.2					
475035	1214917	PS80.3	93088558	23	16.2	493	525.5	0.107	0.09396	29.3	34.95	41.2	46.8
		PS82.2	93088559	9.4		558		0.0809		40.6		52.4	
474226	1225456	PS90.3	93088560	12	9.9	1720	1291.5	0.0569	0.05485	32.1	36.3	90.8	89.4
		PS91	93088561	7.8		863		0.0528		40.5		88	
475420	1225412	PS100.3	93088562	11	8.2	276	276.6	0.0535	0.04475	21.6	21.5	33.4	32.3
		PS102.2	93088563	5.4		277		0.036		21.4		31.2	
471843	1223157	PS110.3V	93088564	19	22.01538	510	383.3077	0.043	0.077308	24.8	25.24616	65.9	43.95385
		PS111.4V	93088565	6.7		267		0.042		28.4		45.4	
		PS112.2V	93088566	5.5		193		0.04		30.2		35.8	
		PS113.0V	93088567	7.9		289		0.0816		33.6		39.6	
		PS114.0V	93088568	11		462		0.0562		25.5		28.3	
		PS110.3A	93088569	94.1		908		0.215		12.6		52.1	
		PS110.3B	93088570	19		321		0.072		27.7		44.6	
		PS110.3C	93088571	66.3		428		0.198		20.3		62.9	
		PS110.3D	93088572	29.9		585		0.0562		23.2		56.6	
		PS112.2A	93088573	6		153		0.05		24.7		29.7	
		PS112.2B	93088574	5.8		312		0.027		23.6		28.8	
		PS112.2C	93088575	9.6		348		0.083		27.9		47.2	
		PS112.2D	93088576	5.4		207		0.041		25.7		34.5	
472827	1224307	PS120.3	93088577	8.5	5.233333	241	183.6667	0.0541	0.045033	20.9	24.63333	24.2	24.43333
		PS122.2	93088578	4.6		172		0.049		27.2		26.6	
		PS292.2SS	93088586	2.6		138		0.032		25.8		22.5	
471723	1232215	PS130.3	93088579	3.9	4.25	2020	1670	0.0717	0.05635	55.2	57.45	135	132.5
		PS132.2	93088580	4.6		1320		0.041		59.7		130	
472232	1225818	PS140.3	93088581	7.6	4.733333	1210	591.6667	0.045	0.0302	23.5	25.23333	55.1	43
		PS141.5	93088582	3.7		303		0.037		29.9		39.9	
		PS1455	93088583	2.9		262		0.0086		22.3		34	
465504	1225420	PS150.3V	93088584	5.7	4.25	603	367.2143	0.02	0.021779	22.8	21.62857	47	40.61429
		PS151.2V	93088585	2.9		425		0.022		22.5		42.8	
		PS152.2V	93088586	2.7		302		0.025		22		39.3	
		PS153.0V	93088587	2.7		210		0.0086		21.5		37.7	
		PS154.3V	93088588	3.9		227		0.0093		19.2		36.2	
		PS312.2SS	93088640	2.9		249		0.016		21.2		35.4	

ALL VALUES = MG/KG

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Pb - Zn)

LAT	LOX	SITE	NO	Pb		Mn		Hg		Ni		Zn	
		PS150.3A	93088589	4.9		312		0.032		21.3		40.1	
		PS150.3B	93088590	6.9		764		0.025		21		47.2	
		PS150.3C	93088591	6.5		799		0.027		21.7		47.3	
		PS150.3D	93088592	6.2		348		0.027		20.8		41	
		PS152.2A	93088593	3.6		183		0.022		20.5		37.2	
		PS152.2B	93088594	3.8		230		0.024		21.4		36.6	
		PS152.2C	93088595	3.1		232		0.02		23		38.2	
		PS152.2D	93088596	3.7		257		0.027		23.9		42.6	
480812	1221653	PS160.3	93088597	22.5	13.5	405	306.5	0.064	0.046	21.7	29.9	51.1	45.15
		PS161.2	93088598	4.5		208		0.028		38.1		39.2	
471307	1222000	PS170.3	93088599	12	7.9	250	216	0.0623	0.04265	11.6	10.65	46.5	36.3
		PS172.2	93088600	3.8		182		0.023		9.7		26.1	
471055	1241132	PS180.3	93088601	20.2	10.975	233	252.75	0.0799	0.065725	7	12.05	32.9	43.65
		PS182.2	93088602	9.1		274		0.108		11.2		37.6	
		PS282.2SS	93088634	7.1		287		0.045		14.8		54.3	
		PS1855	93088603	7.5		217		0.03		15.2		49.8	
474657	1241729	PS190.3	93088604	5.9	6.1	134	234.5	0.0919	0.053633	6.1	12.975	30.1	47.65
		PS192.2	93088605	6.9		300		0.045		15.8		56.4	
		PS1955	93088606	5.5		500		0.024		12.7		54.1	
473919	1222451	PS200.3V	93088607	19	13.72667	516	284.3333	0.0541	0.066833	25.7	27.26667	35.2	32.3
		PS200.8V	93088608	5.1		264		0.031		27.3		28.9	
		PS202.2V	93088609	<2		129		0.028		20.6		19.9	
		PS203.0V	93088610	<2		193		0.023		27.5		22.9	
		PS204.5V	93088611	2.7		244		0.032		27.3		25.2	
		PS200.3A	93088612	46.1		621		0.28		27.2		48.6	
		PS290.3SS	93088635	42.4		519		0.231		27.4		48.1	
		PS200.3B	93088613	37.8		330		0.101		31.6		45.3	
		PS200.3C	93088614	21.9		341		0.0674		27.3		40.6	
		PS200.3D	93088615	11		228		0.033		29		32.4	
		PS202.2A	93088616	3.3		149		0.028		29.7		24.9	
		PS280.3SS	93088633	4.9		252		0.029		22.9		38.7	
		PS202.2B	93088617	2.9		148		0.023		28.6		24.4	
		PS202.2C	93088618	3.1		147		0.022		30.7		25.1	
		PS202.2D	93088619	3.7		184		0.02		26.2		24.3	
470353	1221824	PS210.3	93088620	10	10	1020	679.5	0.0869	0.07595	12.6	19.1	36.9	41.7
		PSWRF2.7	90478097	10		339		0.065		25.6		46.5	
465501	1223333	PS220.3	93088621	3.8	4.6	697	740	0.023	0.0265	11.9	21.7	54.2	58.45

ALL VALUES = MG/KG

10-25

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Pb - Zn)

LAT	LONG	SITE	NO.	Pb		Mn		Hg		Ni		Zn	
		PSWRF2.5	90478098	5.4		783		0.03		31.5		62.7	
465728	1223904	PS230.3	93088622	3.5	4.75	386	365	0.034	0.0365	11.6	17.35	27.5	32.7
		PSWRF2.5	90478099	6		344		0.039		23.1		37.9	
475451	1221040	PS240.3	93088623	13	10.15	784	770.5	0.0595	0.05325	32.8	44.5	72.2	81.45
		PSWRF2.5	90478100	7.3		757		0.047		56.2		90.7	
482413	1221025	PS250.3	93088624	4	3.8	245	361.5	0.028	0.043	131	244.5	38.8	43.35
		PSWRF2.7	90478101	3.6		478		0.058		358		47.9	
464743	1221631	PSLB10.3	93088625	31.5	13.5	364	387.5	0.0665	0.05675	9.8	10.05	67.3	52.35
		PSLB12.2	93088626	7.5		411		0.047		10.3		37.4	
472742	1221326	PSLB20.3	93088627	4.4	4.45	772	753.5	0.049	0.0631	43.5	52.7	72.6	78.1
		PSLB22.2	93088628	4.5		735		0.0772		61.9		83.6	
460223	1184019	PS260.3RS	93088629	5.9	5.95	420	411	0.0065	0.0068	11.4	10.65	47.6	47.95
		PS262.2RS	93088630	6		402		0.0071		9.9		48.3	
472457	1184356	SB10.3	92268500	8	5.75	364	366	0.017	0.0172	7.3	8.325	47.3	46.15
		SB330.3SS	92268574	8.3		353		0.017		7.5		49.8	
		SB12.2	92268501	5		369		0.029		8.4		41.7	
		SB320.3SS	92268573	5.7		378		0.0058		10.1		45.8	
473910	1180946	SB20.3	92268502	15	14.33333	443	463.3333	0.016	0.014333	8.4	9.466667	54.6	51.8
		SB340.3SS	92268575	15		435		0.013		8.6		55.6	
		SB22.2	92268503	13		512		0.014		11.4		45.2	
475026	1175046	SB30.3	92268504	11	12	515	470	0.013	0.009475	7.6	9.2	51.9	53.3
		SB32.2	92268505	13		526		0.0074		10		54.4	
		SB270.3 SS	92268568	14		520		<0.005		10.5		58.5	
		SB3SSBD	92268506	10		319		0.015		8.7		48.4	
470819	1174318	SB40.3	92268507	8.2	8.8	418	436	0.018	0.019	12.3	12.2	41.2	41.05
		SB41.2	92268508	9.4		454		0.02		12.1		40.9	
474232	1173037	SB50.3	92268509	9.1	10.05	586	558	0.035	0.0225	8	8.7	70.6	67.45
		SB51.3	92268510	11		530		0.01		9.4		64.3	
480033	1172325	SB60.3	92268511	9.6	8.75	730	577.75	0.012	0.01225	11.1	9.875	58.5	46.3
		SB290.3SS	92268570	10		1170		0.012		11.8		66.3	
		SB62.2	92268512	8.8		242		0.009		10		38.6	
		SB6SS	92268513	6.6		169		0.016		6.6		21.8	

ALL VALUES = MG/KG

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Pb - Zn)

LAT	LONG	SITE	NO.	Pb		Mn		Hg		Ni		Zn	
481824	1173603	SB70.3	92268514	10	8.666667	847	557.3333	0.022	0.012667	9.8	8.1	70.7	61.8
		SB71.8	92268515	12		597		0.0067		10.2		81.9	
		SB7SS	92268516	4		228		0.0093		4.3		32.8	
475949	1181738	SB80.3	92268517	17	15.66667	488	446	0.013	0.0105	9.1	10.03333	56.1	52.66667
		SB310.3SS	92268572	18		452		0.011		10.2		57	
		SB82.2	92268518	12		398		0.0075		10.8		44.6	
485517	1173112	SB90.3	92268519	15	12.83333	434	394.3333	0.025	0.0168	18.1	16.7	56.3	70.8
		SB91.4	92268520	14		535		0.018		20		58	
		SB9SBD	92268521	9.5		214		0.0074		12		98.1	
480433	1171952	SB100.3	92268522	17	16	858	655	0.021	0.0185	11.6	11.8	78.4	71
		SB102.2	92268523	15		452		0.016		12		63.6	
474434	1175413	SB110.3	92268524	15	13.5	514	561.25	0.015	0.014625	13.5	12.55	64.4	61.325
		SB111.3	92268525	12		777		0.0085		13.2		60	
		SB350.3SS	92268576	15		456		0.024		12.7		59.4	
		SB11SBD	92268526	12		498		0.011		10.8		61.5	
474018	1174407	SB120.3	92268527	11	10.5	514	505	0.014	0.0215	14	16.4	43.8	43.2
		SB122.2	92268528	10		496		0.029		18.8		42.6	
471929	1170403	SB130.3	92268529	10	10.875	550	764.75	0.018	0.01625	16	15.775	51.8	47.575
		SB300.3SS	92268571	12		656		0.017		15.4		51.9	
		SB132.2	92268530	13		1030		0.02		19.9		48	
		SB13SBD	92268531	8.5		823		0.01		11.8		38.6	
472534	1171355	SB140.3	92268532	10	9.05	469	390.875	0.027	0.014063	12.6	10.85125	45.3	42.4875
		SB142.2	92268533	9.4		481		0.017		12.2		50.3	
		SB140.3V	92268534	9.3		445		0.019		11.7		46	
		SB140.8V	92268535	10		411		0.013		10.8		46.2	
		SB142.2V	92268536	8.3		381		0.01		10.3		37.8	
		SB280.3SS	92268569	11		397		<0.005		11.2		43.6	
		SB143.7V	92268537	7.4		305		0.013		9.61		36.7	
		SB145.0V	92268538	7		238		0.011		8.4		34	
470433	1171952	SB150.3	92268539	12	10.8	614	638.5	0.017	0.014	12	12.05	51.2	44.3
		SB152.2	92268540	9.6		663		0.011		12.1		37.4	
472343	1172004	SB160.3	92268541	9.3	10.65	498	599	0.014	0.01195	17.5	18.6	47.4	48.15
		SB162.2	92268542	12		700		0.0099		19.7		48.9	

ALL VALUES = MG/KG

10-27

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Pb - Zn)

LAT	LONG	SITE	NO	Pb		Mn		Hg		Ni		Zn	
474257	1174500	SB170.3	92268543	16	15	477	475	0.0096	0.008	11.2	12.35	61.5	56
		SB172.2	92268544	14		473		0.0084		13.5		50.5	
474346	1170832	SB180.3	92268545	11	11.5	601	461	0.019	0.01075	10.4	9.75	62.2	55.65
		SB182.2	92268546	12		321		<0.005		9.1		49.1	
475233	1173614	SB190.3V	92268547	14	15.77857	464	417.4286	0.017	0.006164	10.5	10.36643	54.2	50.89286
		SB191.2V	92268548	14		354		<0.005		10		51.1	
		SB192.2V	92268549	15		330		<0.005		10.7		43.9	
		SB193.6V	92268550	23.9		349		<0.005		12.2		41.3	
		SB194.4V	92268551	17		371		<0.005		11.6		45.8	
		SB190.3A	92268552	14		563		<0.005		10.6		66.2	
		SB192.2A	92268553	14		490		0.0069		12		61.7	
		SB190.3B	92268554	15		508		0.0096		10.3		53.8	
		SB192.2B	92268555	13		276		<0.005		8.73		35.2	
		SB190.3C	92268556	16		483		0.0058		10.2		54	
		SB192.2C	92268557	17		424		0.0147		12.5		50.8	
		SB190.3D	92268558	14		501		<0.005		8.3		49.8	
		SB192.2D	92268559	14		299		0.0053		8.9		38.5	
		SB19.SS	92268560	20		432		0.0095		8.6		66.2	
474232	1171937	SB200.3	92268561	9.9	8.35	600	611	0.256	0.1312	5.2	4.9	59.9	68.4
		SB202.2	92268562	6.8		622		0.0064		4.6		76.9	
473743	1171000	SB210.3	92268563	12	12.8	518	454	<0.005	0.00425	9.3	9.8	58.2	53.9
		SBRU2.3	90478140	13.6		390		0.006		10.3		49.6	
474313	1173053	SB220.3	92268564	13	12.5	682	555	0.012	0.012	10.3	12.45	53.9	50.35
		SBRU2.5	90478141	12		428		0.012		14.6		46.8	
475037	1175147	SB230.3	92268565	11	11	441	445.5	0.0087	0.00635	8.9	11.4	40.3	44.25
		SBRU2.8	90478142	11		450		0.004		13.9		48.2	
475002	1175805	SB240.3	92268566	10	10.6	382	375.5	<0.005	0.00475	8.8	9.65	43.5	44.05
		SBRU2.6	90478143	11.2		371		0.007		10.5		44.6	
475232	1180911	SB250.3	92268567	8.5	9.5	365	354.5	0.0053	0.00565	9.1	10.15	41.1	42
		SBRU2.6	90478144	10.5		344		0.006		11.2		42.9	
475453	1172838	SB380.3	92268577	12	10.65	496	374	0.0083	0.0054	10.4	9.85	62	53.35
		SB382.2	92268578	9.3		252		<0.005		9.3		44.7	
475349	1171054	SB390.3	92268579	8.6	7.8	1140	769.5	0.0079	0.0065	5.4	4.6	34.7	29.7

ALL VALUES = MG/KG

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Pb - Zn)

LAT	LO	SITE	NO	Pb		Mn		Hg		Ni		Zn	
		SB391.5	92268580	7		399		0.0051		3.8		24.7	
463437	1205022	YB10.3	91258554	4.5	4.5	761	761	0.017	0.017	9.8	9.8	60.6	60.6
463222	1202650	YB20.3	91258556	6.2	6.2	510	510	0.014	0.014	19.3	19.3	53.6	53.6
463153	1203223	YB30.3	91258558	5.9	5.9	613	613	0.011	0.011	14.8	14.8	55.9	55.9
462623	1195653	YB40.3	91258559	7.3	7	552	493.5	0.013	0.0165	17.6	19.1	54.6	52.7
		YB42.2	91258560	6.7		435		0.02		20.6		50.8	
461355	1192417	YB50.3A	91258566	6.8	9.657143	461	488	0.014	0.017714	13.5	14.95	51.9	58.46429
		YB50.3B	91258568	4.4		437		0.011		11.9		45.4	
		YB50.3C	91258537	11		469		0.026		15.1		56.8	
		YB50.3D	91258539	9.7		505		0.019		14.2		58.9	
		YB50.3V	91258574	11		465		0.018		12.5		55	
		YB340.3SS	91258582	11		470		0.017		14.5		55.8	
		YB50.7V	91258575	9.5		525		0.014		14.1		58.9	
		YB51.3V	91258576	12		477		0.016		18		62.7	
		YB52.2A	91258567	9.3		546		0.02		15.1		65.4	
		YB52.2B	91258564	5.5		435		0.012		13.9		51.3	
		YB52.2C	91258538	9.2		518		0.016		15.4		65.5	
		YB52.2D	91258540	9.8		505		0.021		16.3		63.3	
		YB52.2V	91258577	13		484		0.025		16.6		60.4	
		YB53.2V	91258565	13		535		0.019		18.2		67.2	
461445	1200151	YB60.3	91258562	8	6.433333	875	840	0.028	0.030333	36.6	40.36667	73.3	77.43333
		YB332.2SS	91258569	7.2		876		0.027		37.9		79.3	
		YB62.2	91258563	4.1		769		0.036		46.6		79.7	
460709	1204921	YB70.3	91258421	5.15	3.875	1460	1375	0.029	0.023	11.4	13.55	92.5	90.7
		YB72.2	91258422	2.6		1290		0.017		15.7		88.9	
460959	1203706	YB80.3	91258423	4.6	4.066667	681	671	0.022	0.028333	14	16.06667	58.5	60.7
		YB362.2	91258429	3.1		638		0.021		12.5		56.6	
		YB81.8	91258424	4.5		694		0.042		21.7		67	
461920	1202619	YB90.3A	91258571	3.7	2.171429	250	638.3571	0.023	0.018914	12.5	13.25357	52.4	48.50714
		YB90.3B	91258573	<2		514		0.019		10.7		47.3	
		YB90.3C	91258578	<2		1350		0.016		13.4		51.3	
		YB342.2SS	91258583	2.1		1160		0.022		11.8		50.4	
		YB90.3D	91258581	2.4		475		0.014		11.8		53.8	
		YB90.3V	91258417	2.7		412		0.019		9.2		44.3	
		YB90.7V	91258418	<2		392		0.014		4.9		28	

ALL VALUES = MG/KG

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Pb - Zn)

LAT	LONG	SITE	NO	Pb	Mn	Hg	Ni	Zn					
		YB92.2A	91258572	2.3	566	0.019	18	53.8					
		YB92.2B	91258580	<2	354	0.0058	9.45	32.8					
		YB92.2C	91258579	2.6	729	0.011	14.2	48.2					
		YB92.2D	91258541	<2	501	0.016	10.1	43.3					
		YB92.2V	91258419	2.3	507	0.02	12.3	42.8					
		YB93.5V	91258420	<2	756	0.031	24.3	62					
		YB95.0V	91258570	6.3	971	0.035	22.9	68.7					
462827	1202727	YB100.3	91258542	8.3	5.1	701	708.5	0.02	0.0275	17	18.3	61.8	60.3
		YB102.2	91258543	3.9		716		0.035		19.6		58.8	
464415	1203715	YB110.3	91258544	5.1	9.133333	501	427.6667	0.012	0.0406	8.7	10.3	43.9	41.03333
		YB360.3SS	91258412	3.3		397		0.046		10.8		39.3	
		YB112.2	91258411	19		385		0.0638		11.4		39.9	
471215	1205848	YB12.2	91258555	<2	5.4	607	564.4286	0.0085	0.030464	11.3	81.75714	62.4	49.72143
		YB120.3A	91258430	6.5		543		0.018		75.3		44.7	
		YB120.3B	91258432	8.7		593		0.015		60.3		43.4	
		YB120.3C	91258413	6.9		668		0.016		59.8		44.8	
		YB120.3D	91258415	7.3		660		0.016		59.6		48.2	
		YB120.3V	91258425	2.6		936		0.022		57.5		48.4	
		YB120.7V	91258426	<2		583		0.032		67.6		47	
		YB121.0V	91258427	2.3		514		0.032		70.2		50.9	
		YB122.2A	91258431	7.3		434		0.017		133		49.1	
		YB122.2B	91258433	7.4		385		0.014		72.1		44.1	
		YB122.2C	91258414	7.4		433		0.017		140		52.3	
		YB122.2D	91258416	8.2		466		0.17		74.1		51.3	
		YB122.2V	91258428	3.8		555		0.026		80.8		51.9	
		YB123.2V	91258526	5.2		525		0.023		183		57.6	
471015	1205856	YB130.3	91258404	5.1	6.5	1250	1119	0.022	0.082	35.1	38	113	101.4333
		YB350.3SS	91258408	7.9		1540		0.17		34.7		115	
		YB132.2	91258405	6.5		567		0.054		44.2		76.3	
470505	1202520	YB140.2	91258524	7.6	4.8625	809	1546.125	0.014	0.0123	14.2	16.1	65.5	62.9125
		YB140.2V	91258545	5.5		1610		0.014		16.1		64.6	
		YB140.6V	91258546	4.5		1600		0.015		14.7		61.8	
		YB330.3SS	91258551	4		2000		0.013		16.4		61.4	
		YB141.0	91258523	5.1		1050		0.018		16.4		59.1	
		YB141.0V	91258547	4.5		2110		0.0088		19.3		66.2	
		YB141.7V	91258548	3.4		1740		0.0088		16.5		66.3	
		YB142.5V	91258525	4.3		1450		0.0068		15.2		58.4	
465850	1204027	YB150.3	91258549	8.2	7.05	725	741.5	0.015	0.016	14.8	15.5	49.3	51.35

ALL VALUES = MG/KG

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Pb - Zn)

LAT	LONG	SITE	NO.	Pb	Mn	Hg	Ni	Zn					
		YB151.6	91258550	5.9	758	0.017	16.2	53.4					
471047	1204419	YB160.3	91258406	4.9	7.166667	539	555.6667	0.016	0.017333	23.3	24	45	44.3
		YB352.2SS	91258409	8.3	554	0.018	22.3	44.3					
		YB162.2	91258407	8.3	604	0.018	26.4	43.6					
471407	1204807	YB170.3	91258552	5.4	5.3	647	631	0.016	0.032	40.4	48.25	44.4	43.76
		YB172.1	91258553	5.2	615	0.048	56.1	43.1					
463713	1211038	YB180.3	91258528	5.1	5.4	1440	1008	0.021	0.024	15.8	17.3	61.7	54.76
		YB182.2	91258527	5.7	576	0.027	18.8	47.8					
462441	1205344	YB190.3	91258403	6.9	5.728571	1248	1210.857	0.018	0.016143	11.8	12.68571	111	94.17143
		YB190.3V	91258529	6.1	1250	0.014	12.1	112					
		YB190.7V	91258530	5.7	1020	0.014	12	95.4					
		YB191.2V	91258400	6.3	1110	0.015	13.6	87.1					
		YB192.2	91258410	9.4	998	0.016	11.6	76.3					
		YB192.2V	91258401	7.1	1350	0.015	15.3	85.6					
		YB194.0V	91258402	5.6	1500	0.021	12.4	91.8					
470048	1210530	YB200.3	91258533	7	5.65	261	164.45	0.015	0.0155	2.6	2.15	54.7	45.7
		YB201.0	91258534	6.3	67.9	0.016	1.7	36.7					
472528	1203915	YB210.3	91258535	21.2	17.1	863	786.5	0.118	0.1165	187	163	84	78.85
		YB210.8	91258536	13	710	0.115	139	73.7					
472417	1212858	YB22.2	91258557	5.4	15.2	575	384.3333	0.026	0.051	28.4	14.53333	54.6	39.26667
		YB220.3	91258531	31.8	286	0.0708	5.5	26.7					
		YB222.0	91258532	8.4	292	0.0562	9.7	36.5					
461432	1191954	YB230.3	91258439	6.6	7.4	396	392.5	0.0085	0.00725	13	12.9	45.7	43.6
		YBRO2.5	90478123	8.2	389	0.006	12.8	41.5					
461727	1194425	YB240.3	91258440	7.8	8.25	432	396.5	0.022	0.0205	18.3	17.4	48.9	44.7
		YBRO2.5	90478124	8.7	361	0.019	16.5	40.5					
462522	1204526	YB250.3	91258441	8	8.1	524	494.5	0.011	0.021	15.7	16.35	50.6	45.55
		YBRO2.5	90478125	8.2	465	0.031	17	40.5					
461843	1202937	YB260.3	91258442	8.5	9.7	561	520.5	0.016	0.0265	17.8	18.35	58.7	53.05
		YBRO2.3	90478126	10.9	480	0.037	18.9	47.4					
464114	1203916	YB270.3	91258443	5.1	6.05	411	385	0.0877	0.07435	15	15.35	58.4	50.4
		YBRO2.2	90478127	7	361	0.061	15.7	42.4					

ALL VALUES = MG/KG

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

WASHINGTON BACKGROUND SOIL METALS DATA (Pb - Zn)

LAT	LONG	SITE	NO	Pb		Mn		Hg		Ni		Zn	
470433	1202247	YB280.3	91258435	5.2	7.3	596	540.5	0.012	0.011	7.4	8.55	65.7	68.1
		YBRM2.5	90478118	9.4		485		0.01		9.7		70.5	
465846	1203919	YB290.3	91258436	6.5	7.85	680	580	0.01	0.01	28	28.95	69.7	75.2
		YBRM2.6	90478119	9.2		680		0.01		29.9		80.7	
465114	1201724	YB300.3	91258437	6.1	6.35	519	486	0.019	0.0345	15.3	20.95	44.7	40.85
		YBRM2.6	90478120	6.6		453		0.05		26.6		37	
465112	1201624	YB310.3	91258438	5.2	6.55	618	716	0.011	0.0105	9.6	10.7	48	46.6
		YBRM2.6	90478121	7.9		814		0.01		11.8		45.2	
470058	1203855	YB32.2	91258561	3.7	6.133333	625	547.3333	0.038	0.035667	24	22.13333	61.9	47.23333
		YB320.3	91258434	4.9		531		0.019		14.8		41	
		YBRM2.3	90478122	6.8		486		0.05		27.6		38.8	
		YB370.3RS	91258444	4	4	265	269	0.048	0.0495	26	26.3	30	30.45
		YB372.2RS	91258445	4		273		0.051		26.6		30.9	

ALL VALUES = MG/KG

SHADED COLUMN = MEAN VALUE PER SAMPLING LOCATION

XI. MTCASat CALCULATIONS & SUMMARY STATISTICS

Calculation of Background Values

This Section contains all of the MTCASat (MTCASat is a software package developed for use with Microsoft Excel to meet the need for a fast, simple, integrated method of performing routine statistical analyses described in the statistical *Guidance for Ecology Site Managers*) calculations for 12 elements (Al, As, Be, Cd, Cr, Fe, Hg, Mg, Mn, Ni, Pb, Zn). The 90th percentile value is used by Ecology to calculate natural background values. For more information on how to calculate the 90th percentile, consult the "Statistical Guidance for Site Managers" (August, 1992). A summary of all MTCASat statistical calculations is presented in **Table 17**. The statistical distribution maps were prepared using the Statgraphics program.

TABLE 17: BACKGROUND VALUES SUMMARY STATISTICS

ALL VALUES = MG/KG

	GROUP "W"	PUGET SOUND	CLARK COUNTY	WEST (ALL)	STATEWIDE	EAST (ALL)	YAKIMA BASIN	SPOKANE BASIN	GROUP "E"
Al									
MAX	56,550.00	84,900.00	54,550.00	84,900.00	84,900.00	56,550.00	56,550.00	25,850.00	29,000.00
90th	62,905.00	32,581.00	52,276.00	45,735.00	37,206.00	28,299.00	33,379.00	21,376.00	25,591.00
Coeff. Var.	1.20	0.47	0.39	0.63	0.55	0.42	0.38	0.26	0.53
MEAN	25,392.70	20,354.00	34,355.00	25,460.15	21,956.00	18,190.00	22,263.40	15,842.10	15,003.00
MEDIAN	21,700.00	17,900.00	31,192.00	21,760.00	21,956.00	16,600.00	20,800.00	15,000.00	14,800.00
50th	18,748.95	18,376.60	32,446.90	21,899.36	19,277.97	67,234.76	20,892.90	15,380.90	13,525.60
4 X 50th	74,995.80	73,506.40	129,787.60	87,597.44	77,111.88	268,939.04	83,571.60	61,523.60	54,102.40
MIN	5,670.00	7,390.00	13,750.00	5,670.00	5,670.00	6,140.00	10,650.00	8,933.00	6,140.00
As - GFAA ANALYSIS									
MAX	8.99	17.17	6.89	17.168	28.6	28.6	28.6	10.32	7.19
90th	8.47	7.30	6.61	6.37	6.99	7.61	5.13	9.34	5.76
Coeff. Var.	N/A	0.7	0.47	0.58	0.7	0.82	N/A	0.65	0.91
MEAN	3.49	3.96	3.56	3.71	3.82	3.9	3.73	5.02	2.7
MEDIAN	2.8	2.86	3.045	2.91	2.92	2.95	2.64	4.99	2.53
50th	2.80	3.24	3.26	3.19	3.10	3.03	2.64	4.39	2.14
4 X 50th	11.20	12.96	13.04	12.76	12.40	12.12	10.56	17.56	8.56
MIN	1.7	1.45	1.45	1.45	0.5	0.5	0.89	1.13	0.5
Be									
MAX	0.89	0.88	2.16	2.16	2.79	2.79	2.79	0.89	0.88
90th	0.75	0.61	2.07	1.51	1.44	1.27	1.57	0.64	0.61
Coeff. Var.	0.73	0.44	0.35	1.03	0.78	0.50	0.39	0.22	0.45
MEAN	0.39	0.41	1.43	0.75	0.76	0.77	1.03	0.65	0.38
MEDIAN	0.40	0.36	1.48	0.53	0.67	0.72	0.93	0.66	0.31
50th	0.39	0.35	1.43	0.51	0.59	0.70	0.97	0.64	0.35
4 X 50th	1.56	1.40	5.72	2.04	2.36	2.80	3.88	2.56	1.40
MIN	0.10	0.19	0.30	0.10	0.10	0.21	0.39	0.38	0.23
Cd									
MAX	N/A	5.00	1.32	5.00	5.00	1.32	1.32	0.69	N/A
90th	0.10	0.77	0.93	1.20	0.99	0.61	0.93	0.72	N/A
Coeff. Var.	N/A	N/A	0.54	N/A	1.09	0.88	0.54	0.58	N/A
MEAN	N/A	0.80	0.55	0.83	0.63	0.48	0.55	0.40	N/A
MEDIAN	N/A	0.40	0.49	0.83	0.49	0.48	0.49	0.40	N/A
50th	0.10	0.37	0.49	0.40	0.32	0.30	0.49	0.36	N/A
4 X 50th	0.40	1.48	1.96	1.60	1.28	1.20	1.96	1.44	N/A
MIN	N/A	0.10	0.16	0.10	0.10	0.13	0.16	0.13	N/A

TABLE 17: BACKGROUND VALUES SUMMARY STATISTICS

ALL VALUES = MG/KG

	GROUP "W"	PUGET SOUND	CLARK COUNTY	WEST (ALL)	STATEWIDE	EAST (ALL)	YAKIMA BASIN	SPOKANE BASIN	GROUP "E"
Cr									
MAX	163.00	235.00	28.83	235.00	235.00	110.30	110.30	20.25	71.30
90th	78.46	48.15	26.57	47.40	41.88	31.88	38.27	17.81	37.80
Coeff. Var.	0.95	N/A	N/A	N/A	0.70	0.68	N/A	0.36	0.85
MEAN	37.74	30.29	20.64	28.67	23.37	17.67	21.67	11.95	18.92
MEDIAN	26.70	22.00	21.99	22.00	18.42	13.15	16.42	11.78	12.60
50th	28.18	22.00	21.99	22.00	18.69	14.51	16.43	11.43	14.69
4 X 50th	112.72	88.00	87.96	88.00	74.76	58.04	65.72	45.72	58.76
MIN	10.10	12.00	4.42	4.42	2.56	2.55	2.55	4.50	5.00
Cu									
MAX	99.40	243.50	51.71	243.50	243.00	53.00	50.15	29.03	53.00
90th	52.85	38.36	34.43	43.23	36.01	28.40	26.47	21.61	28.42
Coeff. Var.	1.56	N/A	0.42	0.81	0.65	0.46	N/A	0.39	N/A
MEAN	21.24	24.43	22.04	23.15	20.46	17.58	20.16	14.42	17.69
MEDIAN	8.05	15.00	21.78	17.80	17.07	16.30	19.23	14.14	14.70
50th	12.75	15.00	20.49	17.36	16.80	16.22	19.23	14.42	14.70
4 X 50th	51.00	60.00	81.96	69.44	67.20	64.88	76.92	57.68	58.80
MIN	4.33	4.00	9.71	4.00	4.00	4.00	4.13	4.04	9.10
Fe									
MAX	62,800.00	112,500.00	59,850.00	112,500.00	112,500.00	58,800.00	58,880.00	27,000.00	30,000.00
90th	49,170.00	36,128.00	58,665.00	50,125.00	43,106.00	36,644.00	51,451.00	25,026.00	29,631.00
Coeff. Var.	0.72	N/A	0.32	0.62	0.52	0.42	0.51	0.25	0.36
MEAN	25,557.33	21,680.10	40,734.60	28,192.00	25,903.72	23,471.67	29,780.40	18,744.84	19,935.70
MEDIAN	18,200.00	17,050.00	38,508.00	21,433.00	22,033.00	22,116.00	28,821.00	18,150.00	21,300.00
50th	21,446.18	17,050.00	39,180.10	24,152.41	22,987.15	21,810.59	27,689.80	18,276.16	19,027.40
4 X 50th	85,784.72	68,200.00	156,720.40	96,609.64	91,948.60	87,242.36	110,759.20	73,104.64	76,109.60
MIN	9,160.00	5,920.00	16,350.00	5,920.00	5,025.00	5,025.00	5,025.00	9,670.00	10,400.00
Hg									
MAX	0.19	0.09	0.05	0.19	0.19	0.31	0.12	0.13	0.03
90th	0.13	0.07	0.04	0.08	0.07	0.04	0.05	0.02	0.02
Coeff. Var.	1.47	0.44	0.37	0.65		0.96	0.75	N/A	N/A
MEAN	0.05	0.05	0.03	0.04		0.02	0.03	0.02	0.01
MEDIAN	0.04	0.04	0.03	0.04	0.03	0.01	0.02	0.01	0.01
50th	0.03	0.04	0.03	0.04		0.01	0.02	0.01	0.01
4 X 50th	0.12	0.16	0.12	0.16	0.00	0.04	0.08	0.04	0.04
MIN	0.01	0.01	0.05	0.01	0.00	0.00	0.01	0.00	0.00

TABLE 17: BACKGROUND VALUES SUMMARY STATISTICS

ALL VALUES = MG/KG

	GROUP "W"	PUGET SOUND	CLARK COUNTY	WEST (ALL)	STATEWIDE	EAST (ALL)	YAKIMA BASIN	SPOKANE BASIN	GROUP "E"
Mn									
MAX	930.00	2,750.00	1,960.00	2,750.00	2,750.00	1,546.12	1,546.00	769.50	652.00
90th	691.75	1,146.00	1,511.00	1,337.27	1,094.85	836.00	1,104.84	663.48	526.59
Coeff. Var.	0.90	0.61	0.50	0.91	0.69	0.43	0.49	0.23	0.33
MEAN	329.30	592.21	924.20	646.71	592.60	534.40	669.00	506.50	364.95
MEDIAN	231.00	474.00	915.50	531.25	509.58	490.75	589.00	470.00	345.00
50th	257.10	461.62	924.20	494.28	492.82	491.30	611.46	494.78	348.73
4 X 50th	1,028.40	1,846.48	3,696.80	1,977.12	1,971.28	1,965.20	2,445.84	1,979.12	1,394.92
MIN	78.00	90.00	150.00	78.00	78.00	164.45	164.45	354.50	233.00
Ni									
MAX	91.10	244.50	66.75	244.50	244.50	163.00	163.00	18.60	34.10
90th	54.19	38.19	21.04	44.20	38.19	24.54	45.89	16.19	22.41
Coeff. Var.	0.97	N/A	N/A	0.65	0.71	N/A	N/A	0.35	0.48
MEAN	25.66	29.82	17.72	25.44	21.49	17.25	24.83	10.96	13.77
MEDIAN	19.10	23.00	16.23	19.20	16.43	12.50	16.30	10.15	11.70
50th	19.12	23.00	16.23	20.57	16.92	12.40	16.23	10.49	12.54
4 X 50th	76.46	92.00	64.92	82.28	67.68	49.60	64.92	41.96	50.16
MIN	7.60	9.00	7.00	7.00	2.15	2.15	2.15	4.60	6.40
Pb									
MAX	12.00	29.60	207.50	207.50	207.50	17.10	17.10	16.00	11.70
90th	10.67	16.83	24.02	20.42	17.09	13.10	11.00	14.91	9.85
Coeff. Var.	0.72	2.14	0.47	1.42	0.79	0.42	0.24	0.42	0.32
MEAN	5.63	15.90	10.65	11.90	10.05	8.44	11.29	7.00	6.92
MEDIAN	4.00	9.80	6.86	8.20	7.90	7.82	6.53	10.80	6.40
50th	4.75	4.47	9.50	5.92	6.98	7.84	11.01	6.56	6.64
4 X 50th	19.00	17.88	38.00	23.68	27.92	31.36	44.04	26.24	26.56
MIN	2.10	4.65	2.13	2.10	2.10	2.17	2.17	6.75	4.20
Zn									
MAX	116.00	132.50	97.70	132.50	132.50	244.50	101.43	71.00	82.30
90th	85.56	85.06	95.52	98.39	85.82	80.91	78.71	66.40	67.47
Coeff. Var.	0.58	0.50	N/A	0.52	0.41	0.35	0.28	0.21	0.35
MEAN	48.41	51.45	76.01	58.34	55.53	55.55	57.54	51.77	45.74
MEDIAN	44.50	43.65	78.50	54.08	51.12	50.64	52.90	50.90	41.00
50th	42.85	46.52	78.50	52.50	51.56	52.29	55.66	50.83	43.40
4 X 50th	171.40	186.08	314.00	210.00	206.24	209.16	222.64	203.32	173.60
MIN	21.10	12.00	21.40	12.00	12.00	26.30	39.30	29.70	26.30

MTCASat Background Calculations
ALUMINUM DATA

ALUMINUM
STATEWIDE DATA

5670
6020
6140
6680
6930
7070
7390
7450
8130
8460
8570
8933.75
8970
9430
9940
10360
10400
10622.5
10650
10713.33
11600
11680
11700
12050
12175
12400
12462
12500
12603.33
12650
12850
12850
13000
13100
13200
13235
13500
13650
13675
13700
13750
13850
14150
14150
14175
14550
14600
14675
14800
14885.71
14975
15000
15066.67
15100
15233.33
15300
15362.5
15400
15450
15600
15700
16366.67
16400

Number of samples		<u>Uncensored values</u>	
Uncensored	166	Mean	21,956.67
Censored	0	Lognormal mean	21,923.33
TOTAL	166	Std. devn.	12,153.93
		Median	19,575.00
		Min.	5,670.00
		Max.	84,900.00
Lognormal distribution?		Normal distribution?	
r-squared is: 0.99		r-squared is: 0.86	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Value corresponding to that percentile is:	
L	Enter percentile	90	37,206.39 37206.3906
L = lognormal		50th	19,277.87 37746.3129
N = normal		4 X 50th	77,111.49 36666.4683
X = neither (so use nonparametric method)		Coefficient of Variation = 0.55	

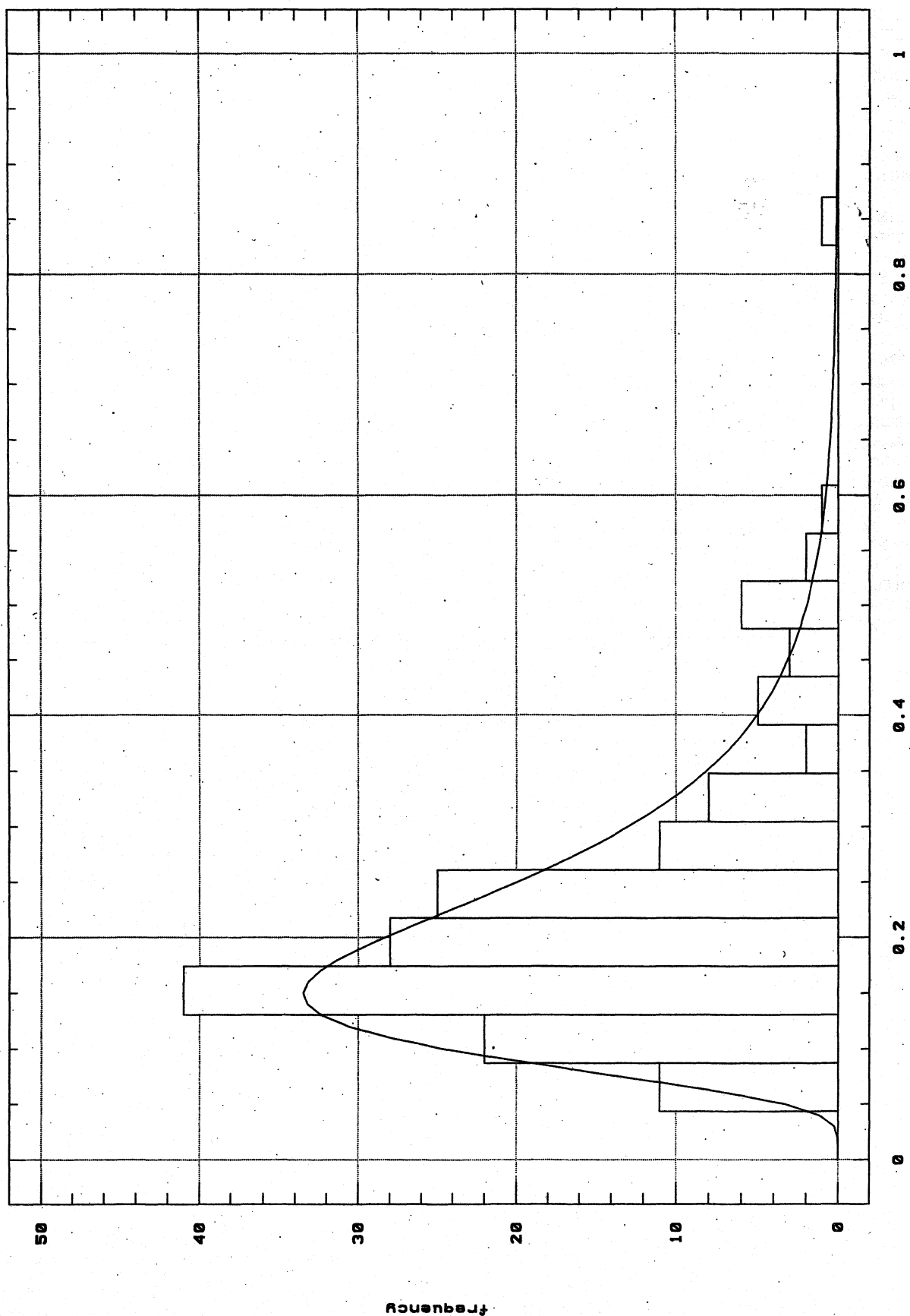
MTCASat Background Calculations
ALUMINUM DATA

16450
16500
16540
16600
16700
16900
16900
16975
17000
17000
17100
17450
17900
18750
18750
18900
19160
19300
19353.85
19450
19700
19850
19950
20066.67
20100
20125
20133.33
20150
20500
20536.67
20675
20700
20750
20800
20850
21275
21400
21700
21700
21820
21914.29
21935.71
21950
22350
22400
22450
23000
23100
23192.86
23233.33
23650
23800
24266.67
24400
24550
24800
24800
24900
25100
25300
25500
25600
25700
25850

MTCASat Background Calculations
ALUMINUM DATA

26666.67
26700
26866.67
26900
27200
27800
28800
29000
29600
30250
30300
30984.62
31400
31800
32300
32578.57
32800
33433.33
34450
37800
37850
39300
41400
41800
42766.67
43000
43800
45700
46100
48500
48657.14
48900
50050
50500

STATEWIDE ALUMINUM DISTRIBUTION



(X 100000)

ALUMINUM 90th = 37.206 MG/KG

Background calculations

5670
6020
6680
7070
7450
16400
16600
21700
25100
28800
37800
46100
50500
51500
53500

AI - GROUP "W" REGIONS "A", "C", "D"

Number of samples		<u>Uncensored values</u>	
Uncensored	15	Mean	25392.67
Censored	0	Lognormal mean	27100.53
TOTAL	15	Std. devn.	18205.86
		Median	21700
		Min.	5670
		Max.	53500
Lognormal distribution?		Normal distribution?	
r-squared is: 0.91		r-squared is: 0.90	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:
L		90	62905.87
L = lognormal		50th	18748.95
N = normal		4 X 50th	74995.80
X = neither (so use nonparametric method)		Coefficient of Variation = 1.2	

MTCAStat Background Calculations

AI - CLARK COUNTY

13750
19353.85
20150
22350
24400
24800
25500
26700
26866.67
26900
30250
30300
30984.62
31400
33433.33
37850
41800
42766.67
43000
43800
45700
48500
48657.14
48900
50050
54550

Number of samples		<u>Uncensored values</u>	
Uncensored	26	Mean	34,335.09
Censored	0	Lognormal mean	34,526.80
TOTAL	26	Std. devn.	11,296.38
		Median	31,192.31
		Min.	13,750.00
		Max.	54,550.00
Lognormal distribution?		Normal distribution?	
r-squared is: 0.95		r-squared is: 0.96	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Value corresponding to that percentile is:	
L	Enter percentile	90	52,276.91 52276.9099
L = lognormal		50th	32,446.91 57113.9831
N = normal		4 X 50th	129,787.65 47439.8367
X = neither (so use nonparametric method)		Coefficient of Variation = 0.39	

MTCASat Background Calculations

AI - PUGET SOUND BASIN

7390
10360
10713.33
11600
11680
12175
12400
12462
12850
13200
13675
13700
13850
14150
14175
14975
15233.33
16366.67
16540
16900
17100
17450
17900
18750
19160
20066.67
20125
20500
20675
20800
21400
21700
21820
21935.71
22400
22450
23192.86
23800
24800
31800
32300
32800
34450
39300
84900

Number of samples		<u>Uncensored values</u>	
Uncensored	45	Mean	20,354.90
Censored	0	Lognormal mean	20,083.46
TOTAL	45	Std. devn.	12,018.80
		Median	17,900.00
		Min.	7,390.00
		Max.	84,900.00
Lognormal distribution?		Normal distribution?	
r-squared is: 0.93		r-squared is: 0.62	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Value corresponding to that percentile is:	
L	Enter percentile	90	32,581.66 32581.6593
L = lognormal		50th	18,376.61 35406.1544
N = normal		4 X 50th	73,506.44 29757.1642
X = neither (so use nonparametric method)		Coefficient of Variation = 0.47	

MTCASat Background Calculations

AI - YAKIMA BASIN

10650
11700
13500
14600
14885.71
15300
15450
15600
16450
16900
17000
18750
19300
19700
20133.33
20750
20850
21914.29
21950
23000
23233.33
24266.67
24550
24900
25300
26666.67
27200
27800
29600
32578.57
41400
56550

Number of samples		<u>Uncensored values</u>	
Uncensored	32	Mean	22263.39
Censored	0	Lognormal mean	22211.65
TOTAL	32	Std. devn.	8991.12
		Median	20800
		Min.	10650
		Max.	56550
Lognormal distribution?		Normal distribution?	
r-squared is: 0.97		r-squared is: 0.82	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:
L		90	33379.65
L = lognormal		50th	20892.85
N = normal		4 X 50th	83571.39
X = neither (so use nonparametric method)		Coefficient of Variation = 0.38	

MTCAStat Background Calculations

AI - SPOKANE BASIN

8933.75
10622.5
12050
12500
12603.33
12650
12850
13100
13235
13650
14150
14550
14675
15000
15066.67
15362.5
15700
16500
16975
17000
19450
19850
19950
20536.67
21275
23650
25850

Number of samples		<u>Uncensored values</u>	
Uncensored	27	Mean	15,842.05
Censored	0	Lognormal mean	15,854.55
TOTAL	27	Std. devn.	4,011.60
		Median	15,000.00
		Min.	8,933.75
		Max.	25,850.00
Lognormal distribution?		Normal distribution?	
r-squared is: 0.98		r-squared is: 0.94	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Value corresponding	
L	Enter percentile	to that percentile is:	
L = lognormal	90	21,376.01	21376.0061
N = normal	50th	15,380.88	22749.6662
X = neither (so use nonparametric method)	4 X 50th	61,523.50	20002.3461
		Coefficient of Variation = 0.26	

MTCASat Background Calculations

6140
6930
8130
8460
8570
8970
9430
9940
10400
13000
14800
15100
15400
16700
18900
20100
20700
23100
25600
25700
29000

AI - GROUP "E"

REGIONS "J","L","P","R"

Number of samples		<u>Uncensored values</u>	
Uncensored	21	Mean	15,003.33
Censored	0	Lognormal mean	15,114.02
TOTAL	21	Std. devn.	6,922.27
		Median	14,800.00
		Min.	6,140.00
		Max.	29,000.00
Lognormal distribution?		Normal distribution?	
r-squared is: 0.96		r-squared is: 0.94	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Value corresponding to that percentile is:	
L		90	25,591.95 25591.9465
L = lognormal		50th	13,525.62 27971.4051
N = normal		4 X 50th	54,102.46 23212.4879
X = neither (so use nonparametric method)		Coefficient of Variation = 0.53	

MTCASat Background Calculations
ARSENIC DATA

ARSENIC

STATEWIDE DATA

DATA BASED ON GRAPHITE FURNACE ATOMIC ABSORPTION (GFAA) ANALYSIS

Number of samples		<u>Uncensored values</u>	
Uncensored	142	Mean	3.82
Censored	0	Lognormal mean	3.77
TOTAL	142	Std. devn.	3.15
		Median	2.92
		Min.	0.50
		Max.	28.60
Lognormal distribution?		Normal distribution?	
r-squared is: 0.98		r-squared is: 0.64	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:
L		90	6.99
L = lognormal		50th	3.10
N = normal		4 X 50th	12.41
X = neither (so use nonparametric method)		Coefficient of Variation = 0.7	

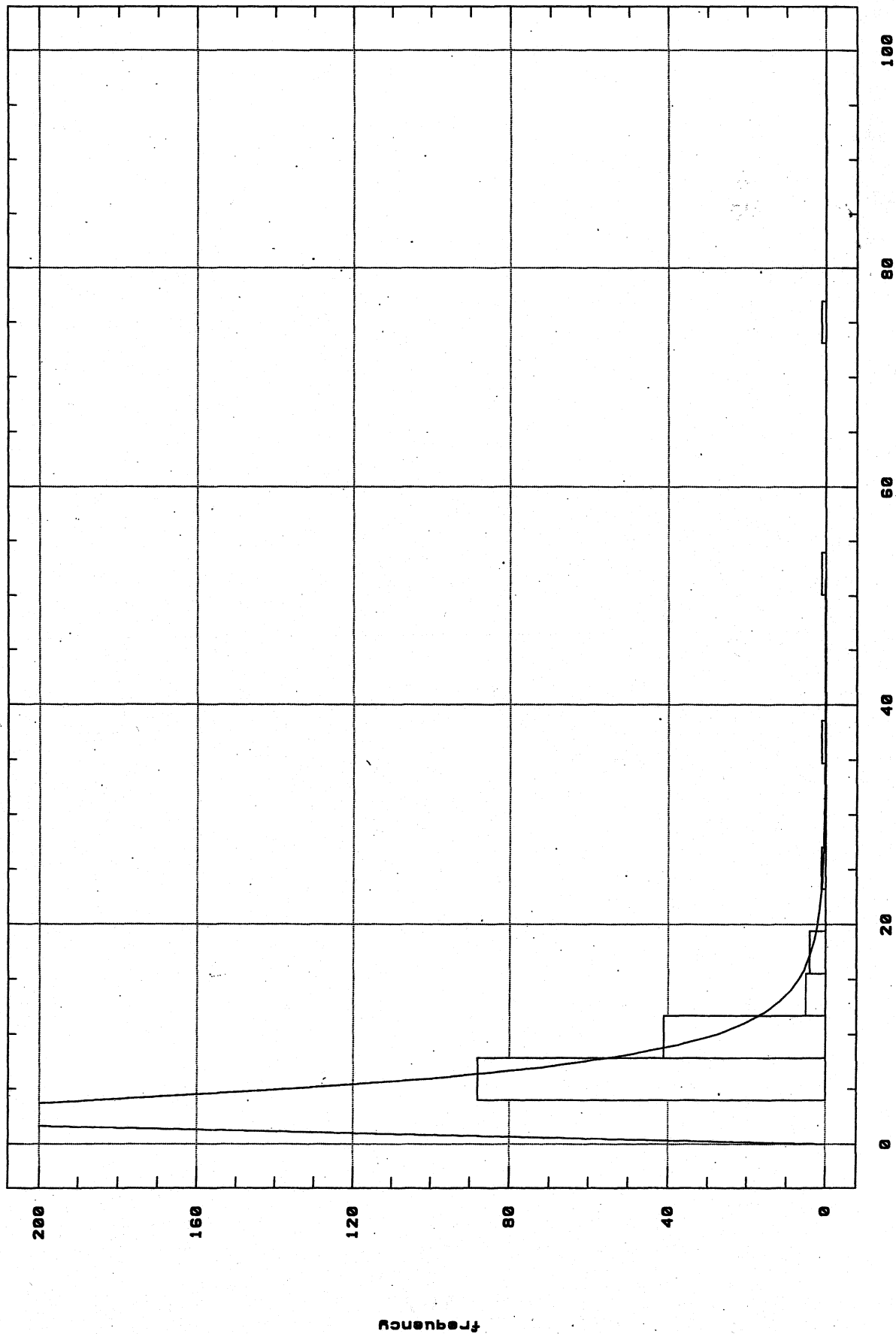
MTCASat Background Calculations
ARSENIC DATA

2.8
2.815
2.83
2.86
2.9
2.9
2.9
2.913333
2.916667
2.935
2.99
2.995
2.995
3.01
3.065
3.08
3.3
3.42
3.45
3.475
3.48
3.485
3.53
3.57
3.57
3.645
3.65
3.67
3.73
3.735
3.796
3.819286
3.862
4.0275
4.1
4.115
4.203333
4.215
4.25
4.274286
4.305
4.326
4.39
4.42
4.55
4.65
4.82
4.995
5.113333
5.16
5.195
5.26
5.28
5.415
5.54
5.55
5.583
5.585
5.818
6.034
6.12
6.41
6.453333
6.89

MTCASat Background Calculations
ARSENIC DATA

6.9275
7.19
7.625714
7.9475
8.01
8.12
8.42
8.53
8.615
8.635
8.99
9.397857
10.32571
17.16846
28.6

STATEWIDE ARSENIC DISTRIBUTION



ARSENIC 90th = 7 MG/KG

MTCASat Background Calculations

1.7
1.8
1.8
1.9
1.9
2.32
2.6
2.8
2.8
2.9
3.48
4.55
4.65
8.12
8.99

As - GROUP "W"

DATA BASED ON GRAPHITE FURNACE ATOMIC ABSORPTION (GFAA) ANALYSIS
WESTERN WASHINGTON, REGIONS A,C,D

Number of samples		<u>Uncensored values</u>	
Uncensored	15	Mean	3.49
Censored	0	Lognormal mean	3.46
TOTAL	15	Std. devn.	2.26
		Median	2.8
		Min.	1.7
		Max.	8.99
Lognormal distribution?		Normal distribution?	
r-squared is: 0.89		r-squared is: 0.75	
Recommendations:			
Use nonparametric method.			
Enter distribution (L, N or X)		Value corresponding to that percentile is:	
X		Enter percentile	90
L = lognormal		50th	2.80
N = normal		4 X 50th	11.20
X = neither (so use nonparametric method)		Coefficient of Variation = N/A	

MTCASat Background Calculations

As - CLARK COUNTY

DATA BASED ON GRAPHITE FURNACE ATOMIC ABSORPTION (GFAA) ANALYSIS

1.45
1.5
2
2.12
2.15
2.65
2.8
2.9
2.913333
2.995
3.01
3.08
3.42
3.67
3.796
4.115
4.42
5.195
5.54
5.583
6.034
6.89

Number of samples		<u>Uncensored values</u>	
Uncensored	22	Mean	3.56
Censored	0	Lognormal mean	3.58
TOTAL	22	Std. devn.	1.50
		Median	3.045
		Min.	1.45
		Max.	6.89
Lognormal distribution?		Normal distribution?	
r-squared is: 0.98		r-squared is: 0.94	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:
L		90	5.81
L = lognormal		50th	3.26
N = normal		4 X 50th	13.05
X = neither (so use nonparametric method)		Coefficient of Variation = 0.47	

MTCASat Background Calculations

As - PUGET SOUND BASIN

DATA BASED ON GRAPHITE FURNACE ATOMIC ABSORPTION (GFAA) ANALYSIS

1.45
1.616667
1.665
1.8
1.975
1.993333
2.145
2.15
2.215
2.3
2.35
2.535
2.83
2.86
2.935
2.99
3.735
3.819286
4.215
4.25
4.274286
4.326
5.585
5.818
8.615
9.397857
17.16846

Number of samples		<u>Uncensored values</u>	
Uncensored	27	Mean	3.96
Censored	0	Lognormal mean	3.85
TOTAL	27	Std. devn.	3.30
		Median	2.86
		Min.	1.45
		Max.	17.1684615
Lognormal distribution?		Normal distribution?	
r-squared is: 0.92		r-squared is: 0.65	
Recommendations:			
Use lognormal distribution.			
GFAA ANALYSIS			
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:
L		90	7.30
L = lognormal		50th	3.24
N = normal		4 X 50th	12.94
X = neither (so use nonparametric method)		Coefficient of Variation = 0.7	

MTCASat Background Calculations

0.89
0.96
1.245
1.3875
1.715
1.8
1.8
1.814286
1.95
2.286667
2.3
2.43
2.5
2.5
2.58
2.706667
2.815
2.916667
2.995
3.065
3.475
3.53
3.57
3.862
4.203333
4.39
4.82
5.16
7.625714
28.6

As - YAKIMA BASIN

DATA BASED ON GRAPHITE FURNACE ATOMIC ABSORPTION (GFAA) ANALYSIS

Number of samples		<u>Uncensored values</u>	
Uncensored	30	Mean	3.73
Censored	0	Lognormal mean	3.44
TOTAL	30	Std. devn.	4.90
		Median	2.64333333
		Min.	0.89
		Max.	28.6
Lognormal distribution?		Normal distribution?	
r-squared is: 0.88		r-squared is: 0.39	
Recommendations:			
Use nonparametric method.			
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:
X		90	5.13
L = lognormal		50th	2.64
N = normal		4 X 50th	10.57
X = neither (so use nonparametric method)		Coefficient of Variation = N/A	

MTCASat Background Calculations

1.136667

1.45

2.3

2.515

2.55

2.74

2.75

3.3

3.45

3.485

3.645

4.0275

4.305

4.995

5.113333

5.26

5.415

5.55

6.41

6.453333

6.9275

7.9475

8.01

8.42

8.53

8.635

10.32571

As - SPOKANE BASIN

DATA BASED ON GRAPHITE FURNACE ATOMIC ABSORPTION (GFAA) ANALYSIS

Number of samples		<u>Uncensored values</u>	
Uncensored	27	Mean	5.02
Censored	0	Lognormal mean	5.13
TOTAL	27	Std. devn.	2.48
		Median	4.995
		Min.	1.13666667
		Max.	10.3257143
Lognormal distribution?		Normal distribution?	
r-squared is: 0.96		r-squared is: 0.96	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:
L		90	9.34
L = lognormal		50th	4.39
N = normal		4 X 50th	17.54
X = neither (so use nonparametric method)		Coefficient of Variation = 0.65	

MTCASat Background Calculations

0.5
0.53
1.1
1.1
1.2
1.4
1.4
1.44
1.49
2.25
2.53
2.6
2.6
2.9
3.57
3.65
3.73
4.1
5.28
6.12
7.19

As - GROUP "E"

DATA BASED ON GRAPHITE FURNACE ATOMIC ABSORPTION (GFAA) ANALYSIS
EASTERN WASHINGTON, REGIONS J,L,P,R

Number of samples		<u>Uncensored values</u>	
Uncensored	21	Mean	2.70
Censored	0	Lognormal mean	2.80
TOTAL	21	Std. devn.	1.83
		Median	2.53
		Min.	0.5
		Max.	7.19
Lognormal distribution?		Normal distribution?	
r-squared is: 0.97		r-squared is: 0.91	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Value corresponding to that percentile is:	
L	Enter percentile	90	5.76
L = lognormal		50th	2.14
N = normal		4 X 50th	8.54
X = neither (so use nonparametric method)		Coefficient of Variation = 0.91	

MTCASat Background Calculations
BERYLLIUM DATA

BERYLLIUM
STATEWIDE DATA

Number of samples		<u>Uncensored values</u>	
Uncensored	157	Mean	0.76
Censored	8	Lognormal mean	0.77
TOTAL	165	Std. devn.	0.49
		Median	0.67
		Min.	0.10
		Max.	2.79
Lognormal distribution?		Normal distribution?	
r-squared is: 0.98		r-squared is: 0.88	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Value corresponding to that percentile is:	
L	Enter percentile	90	1.44
L = lognormal		50th	0.59
N = normal		4 X 50th	2.37
X = neither (so use nonparametric method)		Coefficient of Variation = 0.78	
			1.4373
			1.6116
			1.2629

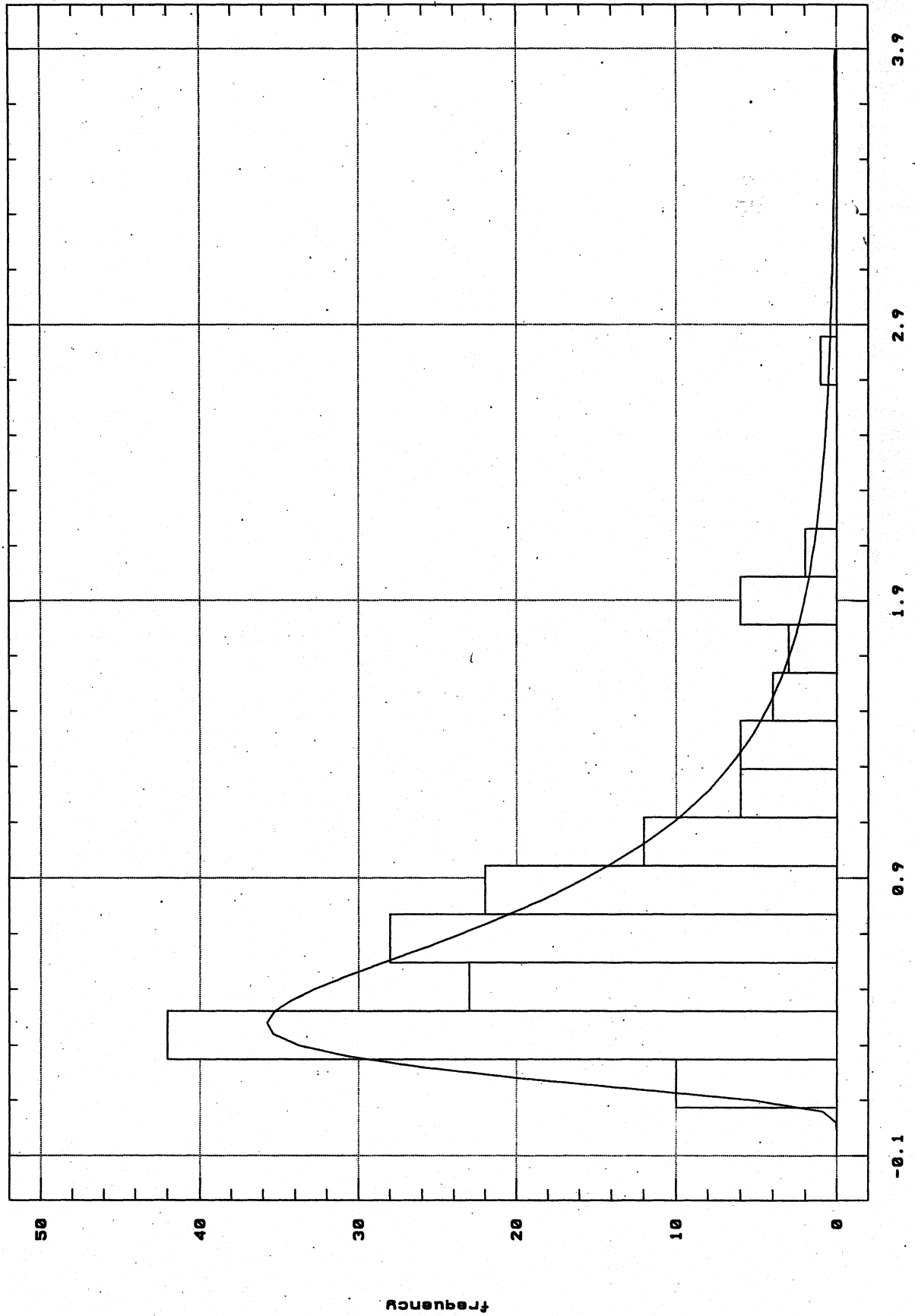
MTCASat Background Calculations
BERYLLIUM DATA

0.53
0.53
0.535
0.54
0.54
0.544
0.55
0.58
0.58
0.58
0.585
0.586667
0.6
0.605
0.61
0.61
0.62625
0.635
0.636429
0.65
0.65
0.655
0.663333
0.665
0.6675
0.67
0.6825
0.7
0.7
0.7
0.7
0.71
0.71
0.72
0.72
0.723333
0.73
0.75
0.75
0.75
0.77
0.77
0.77
0.78
0.785
0.79
0.805
0.815
0.82
0.82
0.82
0.825
0.83
0.84
0.875
0.875
0.89
0.89
0.89
0.89
0.905
0.920714
0.95
0.98

MTCASat Background Calculations
BERYLLIUM DATA

1
1.02
1.030769
1.036667
1.044286
1.046667
1.075714
1.085
1.09
1.11
1.135
1.14
1.15
1.156667
1.21
1.245
1.31
1.335
1.36
1.38
1.4175
1.45
1.475
1.483333
1.483846
1.636667
1.723333
1.743333
1.79
1.815
1.87
1.92
1.94
1.955

STATEWIDE BERYLLIUM DISTRIBUTION



BERYLLIUM 90th = 1.5 MG/KG

MTCASat Background Calculations

0.1
0.1
0.1
0.1
0.13
0.26
0.29
0.4
0.44
0.46
0.6
0.61
0.65
0.71
0.89

Be - GROUP "W"

REGIONS A,C,D - WESTERN WASHINGTON

Number of samples		<u>Uncensored values</u>	
Uncensored	15	Mean	0.39
Censored	0	Lognormal mean	0.42
TOTAL	15	Std. devn.	0.26
		Median	0.4
		Min.	0.1
		Max.	0.89

Lognormal distribution?	Normal distribution?
r-squared is: 0.89	r-squared is: 0.93

Recommendations:	
Use normal distribution.	

Enter distribution (L, N or X)	Enter percentile	Value corresponding to that percentile is:
N	90	0.75
L = lognormal	50th	0.39
N = normal	4 X 50th	1.56
X = neither (so use nonparametric method)	Coefficient of Variation = 0.73	

MTCASat Background Calculations

Be - CLARK COUNTY

0.305
0.585
0.75
1
1.02
1.030769
1.09
1.11
1.135
1.335
1.36
1.45
1.475
1.483333
1.483846
1.636667
1.723333
1.743333
1.79
1.815
1.87
1.92
1.94
1.955
1.99
2.155714

Number of samples		<u>Uncensored values</u>	
Uncensored	26	Mean	1.43
Censored	0	Lognormal mean	1.46
TOTAL	26	Std. devn.	0.47
		Median	1.47916667
		Min.	0.305
		Max.	2.15571429
Lognormal distribution?		Normal distribution?	
r-squared is: 0.83		r-squared is: 0.96	
Recommendations:			
Use normal distribution.			
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:
N		90	2.07
L = lognormal		50th	1.43
N = normal		4 X 50th	5.72
X = neither (so use nonparametric method)		Coefficient of Variation = 0.35	

MTCASat Background Calculations

Be - PUGET SOUND BASIN

0.185
0.23
0.23
0.243333
<0.5
<0.5
<0.5
<0.5
<0.5
<0.5
0.253333
0.256667
0.266154
0.27
0.27
0.291429
0.296667
<0.6
0.305
0.3125
0.32
0.3225
0.33
0.333333
0.35
0.366667
0.37
0.37
0.375
0.395
0.41
0.415
0.47
0.53
0.53
0.544
0.61
0.665
0.7
0.7
0.7
0.75
0.875

Number of samples		<u>Uncensored values</u>	
Uncensored	36	Mean	0.41
Censored	8	Lognormal mean	0.41
TOTAL	44	Std. devn.	0.18
		Median	0.35833333
		Min.	0.185
		Max.	0.875
Lognormal distribution?		Normal distribution?	
r-squared is: 0.91		r-squared is: 0.82	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Value corresponding to that percentile is:	
L	Enter percentile	90	0.61
L = lognormal		50th	0.35
N = normal		4 X 50th	1.40
X = neither (so use nonparametric method)		Coefficient of Variation =	0.44

MTCASat Background Calculations

Be - YAKIMA BASIN

0.39
0.635
0.65
0.7
0.72
0.73
0.77
0.78
0.805
0.815
0.82
0.83
0.89
0.89
0.905
0.920714
0.95
0.98
1.036667
1.044286
1.046667
1.075714
1.085
1.15
1.156667
1.21
1.245
1.31
1.38
1.4175
1.97
2.79

Number of samples		<u>Uncensored values</u>	
Uncensored	32	Mean	1.03
Censored	0	Lognormal mean	1.03
TOTAL	32	Std. devn.	0.43
		Median	0.93535714
		Min.	0.39
		Max.	2.79
Lognormal distribution?		Normal distribution?	
r-squared is: 0.93		r-squared is: 0.76	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Value corresponding to that percentile is:	
L	Enter percentile	90	1.57
L = lognormal		50th	0.97
N = normal		4 X 50th	3.88
X = neither (so use nonparametric method)		Coefficient of Variation = 0.39	

MTCASat Background Calculations

Be - SPOKANE BASIN

0.3775
0.476667
0.495
0.505
0.515
0.535
0.54
0.55
0.58
0.586667
0.605
0.62625
0.636429
0.655
0.663333
0.6675
0.67
0.6825
0.72
0.723333
0.75
0.785
0.82
0.82
0.825
0.875
0.89

Number of samples		<u>Uncensored values</u>	
Uncensored	27	Mean	0.65
Censored	0	Lognormal mean	0.65
TOTAL	27	Std. devn.	0.13
		Median	0.655
		Min.	0.3775
		Max.	0.89
Lognormal distribution?		Normal distribution?	
r-squared is: 0.97		r-squared is: 0.98	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:
L		90	0.84
L = lognormal		50th	0.64
N = normal		4 X 50th	2.55
X = neither (so use nonparametric method)		Coefficient of Variation = 0.22	

MTCASat Background Calculations

0.23
0.23
0.243333
0.253333
0.256667
0.266154
0.27
0.296667
0.305
0.3225
0.366667
0.41
0.415
0.47
0.544
0.665
0.875

Be - GROUP "E"

REGIONS J,L,P,R - EASTERN WASHINGTON

Number of samples		<u>Uncensored values</u>	
Uncensored	17	Mean	0.38
Censored	0	Lognormal mean	0.38
TOTAL	17	Std. devn.	0.18
		Median	0.305
		Min.	0.23
		Max.	0.875
Lognormal distribution?		Normal distribution?	
r-squared is: 0.90		r-squared is: 0.79	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Value corresponding to that percentile is:	
L	Enter percentile	90	0.61
L = lognormal		50th	0.35
N = normal		4 X 50th	1.39
X = neither (so use nonparametric method)		Coefficient of Variation =	0.45

MTCASat Background Calculations
CADMIUM DATA

CADMIUM
STATEWIDE DATA

Number of samples		<u>Uncensored values</u>	
Uncensored	104	Mean	0.63
Censored	61	Lognormal mean	0.62
TOTAL	165	Std. devn.	0.58
		Median	0.49
		Min.	0.10
		Max.	5.00
Lognormal distribution?		Normal distribution?	
r-squared is: 0.91		r-squared is: 0.59	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Value corresponding to that percentile is:	
L	Enter percentile	90	0.99 0.9895
L = lognormal		50th	0.32 1.4052
N = normal		4 X 50th	1.27 0.5738
X = neither (so use nonparametric method)		Coefficient of Variation = 1.09	

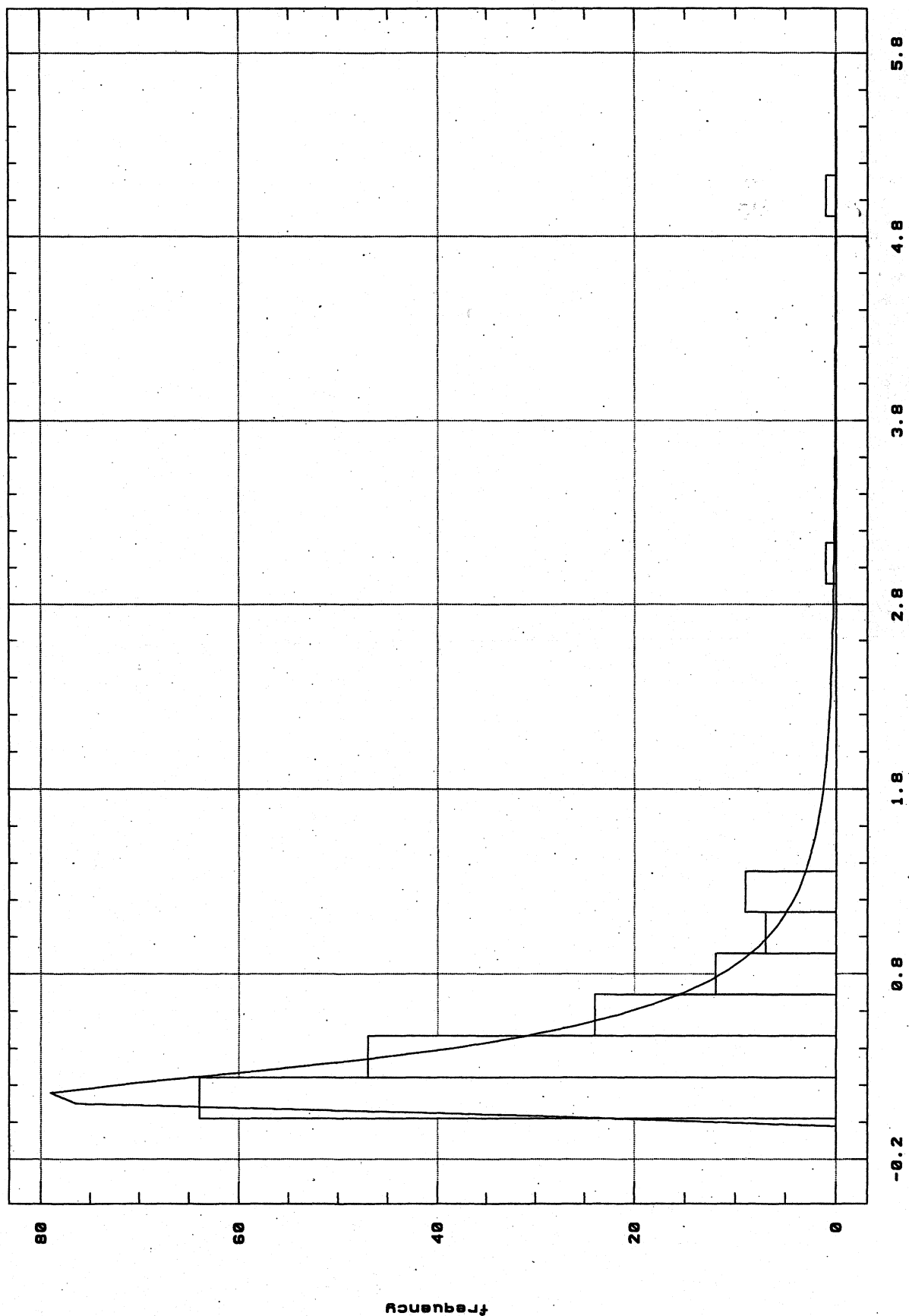
MTCASat Background Calculations
CADMIUM DATA

0.215
0.26
0.275
0.28
0.303333
0.3125
0.32
0.33
0.338571
0.34
0.34
0.35
0.35
0.36
0.365
0.365714
0.37
0.37
0.37
0.375
0.38
0.395
0.4
0.4
0.4
0.4
<0.8
<0.8
<0.8
<0.8
<0.8
<0.8
<0.8
<0.8
<0.8
<0.8
0.405
0.41
0.42
0.424
0.445
0.45
0.453333
0.458462
0.46
0.4625
0.465
0.483333
0.485
0.500714
0.505
0.515
0.525
0.535
0.535
0.54
0.566667
0.57
0.61
0.62
0.626667
0.629286
0.63

MTCASat Background Calculations
CADMIUM DATA

0.645
0.653333
0.66
0.665
0.665714
0.676667
0.676667
0.685
0.7
0.7
0.705
0.715
0.72
0.74
0.8
0.805
0.831429
0.836667
0.8425
0.87
0.92
0.937692
0.955385
0.97
1.06
1.06
1.1
1.2
1.2
1.225
1.225
1.25
1.275
1.294286

STATEWIDE CADMIUM DISTRIBUTION



MTCASat Background Calculations

<0.2
<0.2
<0.2
<0.2
<0.2
<0.2
<0.2
<0.2
<0.2
<0.2
<0.2
<0.2
<0.2

Cd - GROUP "W"

REGIONS A,C,D - WESTERN WASHINGTON

Number of samples		<u>Uncensored values</u>	
Uncensored	0	Mean	N/A
Censored	14	Lognormal mean	N/A
TOTAL	14	Std. devn.	N/A
		Median	N/A
		Min.	N/A
		Max.	N/A
Lognormal distribution?		Normal distribution?	
r-squared is:		r-squared is:	
Recommendations:			
Review of data needed for background decision.			
Enter distribution (L, N or X)		Enter percentile	
L		90	
L = lognormal		50th	
N = normal		4 X 50th	
X = neither (so use nonparametric method)		Coefficient of Variation = N/A	
		Value corresponding to that percentile is:	
		0.10	
		0.10	
		0.40	

MTCASat Background Calculations

Cd - CLARK COUNTY

0.155
0.42
0.445
0.485
0.505
0.535
0.62
0.7
0.705
0.715
0.74
0.805
0.836667
0.92
0.937692
0.955385
0.97
1.06
1.06
1.1
1.2
1.225
1.225
1.25
1.294286
1.3

Number of samples		<u>Uncensored values</u>	
Uncensored	32	Mean	0.55
Censored	0	Lognormal mean	0.55
TOTAL	32	Std. devn.	0.27
		Median	0.49202381
		Min.	0.155
		Max.	1.32857143
Lognormal distribution?		Normal distribution?	
r-squared is: 0.98		r-squared is: 0.89	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Value corresponding to that percentile is:	
L	Enter percentile	90	0.93
L = lognormal		50th	0.49
N = normal		4 X 50th	1.95
X = neither (so use nonparametric method)		Coefficient of Variation = 0.54	

MTCASat Background Calculations

Cd - PUGET SOUND BASIN

Number of samples		<u>Uncensored values</u>	
Uncensored	19	Mean	0.80
Censored	25	Lognormal mean	0.73
TOTAL	44	Std. devn.	1.20
		Median	0.4
		Min.	0.1
		Max.	5
Lognormal distribution?		Normal distribution?	
r-squared is: 0.81		r-squared is: 0.45	
Recommendations:			
More than half the data are censored. Nonparametric method recommended.			
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:
X		90	0.77
L = lognormal		50th	0.37
N = normal		4 X 50th	1.49
X = neither (so use nonparametric method)		Coefficient of Variation = N/A	

MTCASat Background Calculations

Cd - YAKIMA BASIN

0.155
0.185
0.26
0.275
0.32
0.33
0.35
0.35
0.365
0.37
0.37
0.4
0.405
0.45
0.46
0.483333
0.500714
0.515
0.525
0.61
0.629286
0.63
0.66
0.665
0.665714
0.676667
0.72
0.8
0.8425
0.87
1.275
1.328571

Number of samples		<u>Uncensored values</u>	
Uncensored	32	Mean	0.55
Censored	0	Lognormal mean	0.55
TOTAL	32	Std. devn.	0.27
		Median	0.49202381
		Min.	0.155
		Max.	1.32857143
Lognormal distribution?		Normal distribution?	
r-squared is: 0.98		r-squared is: 0.89	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Value corresponding to that percentile is:	
L	Enter percentile	90	0.93
L = lognormal		50th	0.49
N = normal		4 X 50th	1.95
X = neither (so use nonparametric method)		Coefficient of Variation = 0.54	

Background calculations

Cd - SPOKANE BASIN

0.125
0.125
0.18
0.185
0.2
0.215
0.215
0.3125
0.338571
0.34
0.36
0.37
0.375
0.395
0.4
0.41
0.453333
0.4625
0.465
0.535
0.54
0.57
0.626667
0.645
0.653333
0.676667
0.685

Number of samples		<u>Uncensored values</u>	
Uncensored	27	Mean	0.40
Censored	0	Lognormal mean	0.41
TOTAL	27	Std. devn.	0.17
		Median	0.395
		Min.	0.125
		Max.	0.685
Lognormal distribution?		Normal distribution?	
r-squared is: 0.93		r-squared is: 0.96	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Value corresponding to that percentile is:	
L	Enter percentile	90	0.72
L = lognormal		50th	0.36
N = normal		4 X 50th	1.44
X = neither (so use nonparametric method)		Coefficient of Variation = 0.58	

Background calculations

Cd - GROUP "E"

REGIONS "J", "L", "P", "R" - EASTERN WASHINGTON

Number of samples		<u>Uncensored values</u>	
Uncensored	0	Mean	N/A
Censored	21	Lognormal mean	N/A
TOTAL	21	Std. devn.	N/A
		Median	N/A
		Min.	N/A
		Max.	N/A
Lognormal distribution?		Normal distribution?	
r-squared is:		r-squared is:	
Recommendations: <div style="text-align: center; margin-top: 10px;">Review of data needed for background decision.</div>			
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:
L		90	N/A
L = lognormal		50th N/A	
N = normal		4 X 50th N/A	
X = neither (so use nonparametric method)		Coefficient of Variation = N/A	

MTACASat Background Calculations
CHROMIUM DATA

CHROMIUM
STATEWIDE

2.555
4.425
4.5
5
6.1
6.31
6.5675
6.6
7.6
7.67
8.44
8.8
8.953333
9.1
9.11
9.235
9.94
10.1
10.535
10.65
10.8
10.8
10.97667
11.05333
11.4
11.4
11.45
11.6
11.6
11.65
11.73333
11.78857
11.85
12
12.00286
12.03333
12.135
12.2
12.3375
12.6
12.7
12.85
12.96
13.025
13.05
13.15
13.15714
13.25
13.3
14.25
14.3
14.3
14.4
14.65
14.8
15
15.4
15.55
15.85
16
16
16
16.1

Number of samples		<u>Uncensored values</u>		
Uncensored	166	Mean	23.37	
Censored	0	Lognormal mean	22.51	
TOTAL	166	Std. devn.	24.10	
		Median	18.42	
		Min.	2.56	
		Max.	235.00	
Lognormal distribution?		Normal distribution?		
r-squared is: 0.95		r-squared is: 0.48		
Recommendations:				
Use lognormal distribution.				
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:	
L		90	41.88	0.0000
L = lognormal		50th	18.69	0.0000
N = normal		4 X 50th	74.76	0.0000
X = neither (so use nonparametric method)		Coefficient of Variation = 0.7		

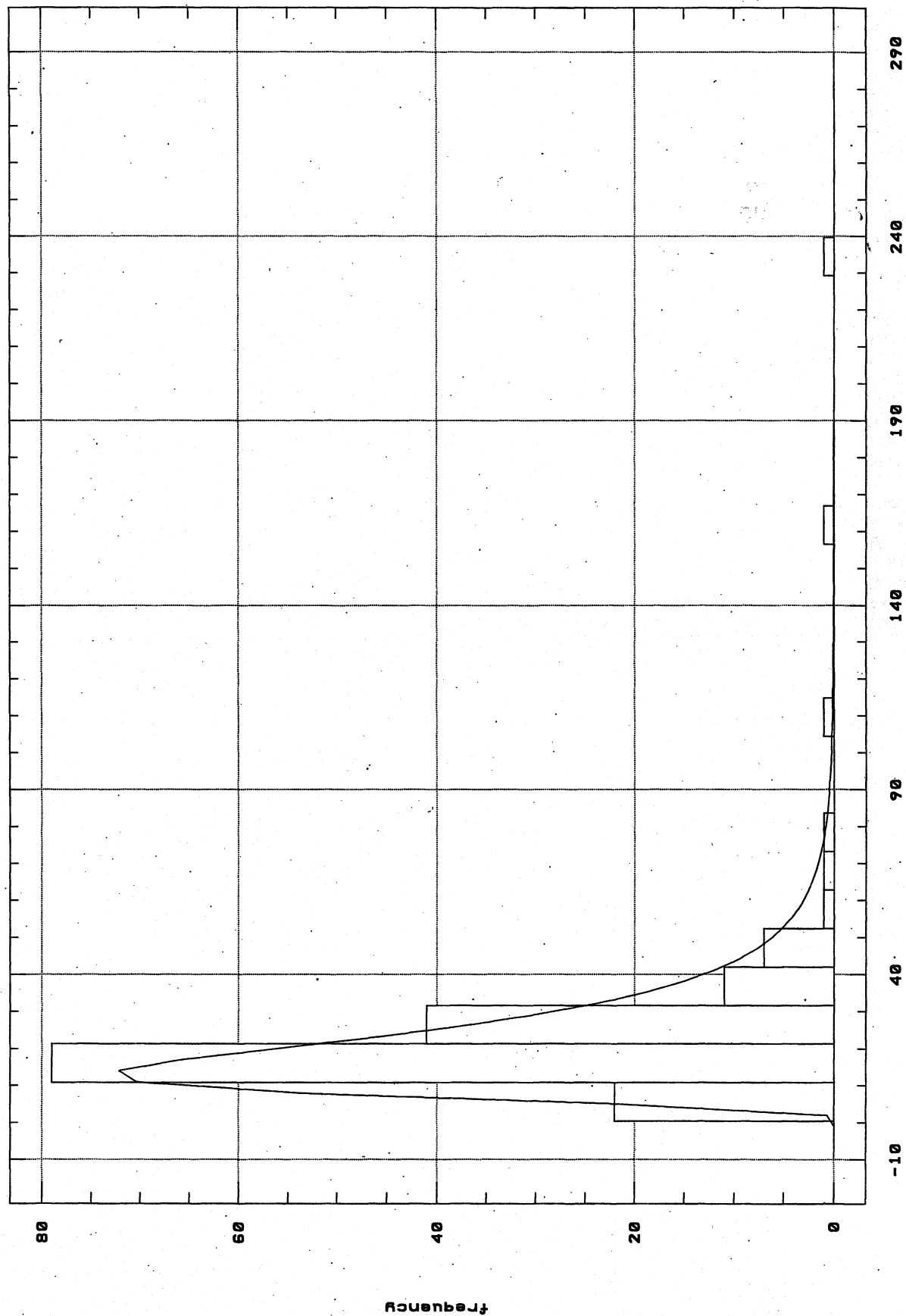
MTACASat Background Calculations
CHROMIUM DATA

16.35
16.36667
16.385
16.45
16.5
16.7
16.75
16.8
16.95
17.15
17.55
17.9
17.95
18.05
18.1
18.1
18.22857
18.3
18.3
18.34286
18.5
18.63333
18.74286
18.75
18.775
19
19
19
19.5
19.92
19.95
20
20
20.25
20.25
20.66667
20.95
21.15
21.225
21.23333
21.5
21.7
21.7
21.91538
22
22
22
22
22.06667
22.2
22.5
22.6
22.625
23
23.11538
23.2
23.26667
23.37143
23.825
23.96667
24
24
24.35
24.35385

MTACASat Background Calculations
CHROMIUM DATA

24.4
24.9
25.1
25.7
26
26.23333
26.7
27.35
28.2
28.83333
29.3
30.3
31.3
31.46667
31.6
32
33.225
34.2
35.3
35.9
36.9
37.85
38.4
38.45
41.2
41.95
45.2
46.02857
47.25
47.75
48.75
49.12143
51.5
56.7

STATEWIDE CHROMIUM DISTRIBUTION



CHROMIUM 90th = 41.8 MG/KG

MTCASat Background Calculations

Cr - GROUP "W"

REGIONS A,C,D - WESTERN WASHINGTON

10.1
11.4
12.2
14.8
16
25.1
26
26.7
32
34.2
41.2
45.2
51.5
56.7
163

Number of samples		<u>Uncensored values</u>	
Uncensored	15	Mean	37.74
Censored	0	Lognormal mean	37.08
TOTAL	15	Std. devn.	37.68
		Median	26.7
		Min.	10.1
		Max.	163
Lognormal distribution?		Normal distribution?	
r-squared is: 0.94		r-squared is: 0.62	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Value corresponding to that percentile is:	
L	Enter percentile	90	78.46
L = lognormal		50th	28.18
N = normal		4 X 50th	112.73
X = neither (so use nonparametric method)		Coefficient of Variation = 0.95	

MTCASat Background Calculations

Cr - CLARK COUNTY

4.425
8.44
14.65
16.45
16.75
18.05
18.1
18.1
18.3
18.75
20.95
21.7
21.91538
22.06667
23.11538
23.2
23.26667
23.37143
23.825
23.96667
24.35
24.9
25.7
26.23333
27.35
28.83333

Number of samples		<u>Uncensored values</u>	
Uncensored	26	Mean	20.64
Censored	0	Lognormal mean	21.09
TOTAL	26	Std. devn.	5.52
		Median	21.9910256
		Min.	4.425
		Max.	28.8333333
Lognormal distribution?		Normal distribution?	
r-squared is: 0.69		r-squared is: 0.89	
Recommendations:			
Use nonparametric method.			
Enter distribution (L, N or X)		Value corresponding to that percentile is:	
X		Enter percentile	90
L = lognormal		50th	21.99
N = normal		4 X 50th	87.96
X = neither (so use nonparametric method)		Coefficient of Variation = N/A	

MTCASat Background Calculations

Cr - PUGET SOUND BASIN

12
14.25
16
16.36667
16.385
17.55
17.95
18.34286
18.74286
19
19
19
19.5
19.92
19.95
20
20.25
20.66667
21.15
21.225
21.5
21.7
22
22
22
22.2
22.5
22.6
22.625
23
24
24
24.35385
24.4
28.2
31.3
33.225
35.3
41.95
47.25
47.75
48.75
49.12143
79.05
235

Number of samples		<u>Uncensored values</u>	
Uncensored	45	Mean	30.29
Censored	0	Lognormal mean	28.28
TOTAL	45	Std. devn.	33.54
		Median	22
		Min.	12
		Max.	235
Lognormal distribution?		Normal distribution?	
r-squared is: 0.75		r-squared is: 0.36	
Recommendations:			
Use nonparametric method.			
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:
X		90	48.15
L = lognormal		50th	22.00
N = normal		4 X 50th	88.00
X = neither (so use nonparametric method)		Coefficient of Variation = N/A	

MTCASat Background Calculations

Cr - YAKIMA BASIN

2.555
 7.67
 11.6
 11.73333
 12.00286
 12.135
 12.96
 13.15
 13.15714
 13.3
 14.3
 14.3
 15
 15.55
 15.85
 16.35
 16.5
 16.7
 16.8
 17.15
 18.22857
 18.5
 18.63333
 21.23333
 22
 30.3
 31.46667
 31.6
 37.85
 38.45
 46.02857
 110.3

Number of samples		<u>Uncensored values</u>	
Uncensored	32	Mean	21.67
Censored	0	Lognormal mean	21.41
TOTAL	32	Std. devn.	18.73
		Median	16.425
		Min.	2.555
		Max.	110.3
Lognormal distribution?		Normal distribution?	
r-squared is: 0.87		r-squared is: 0.57	
Recommendations:			
Use nonparametric method.			
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:
X		90	38.27
L = lognormal		50th	16.43
N = normal		4 X 50th	65.70
X = neither (so use nonparametric method)		Coefficient of Variation = N/A	

MTCASat Background Calculations

Cr - SPOKANE BASIN

4.5
6.31
6.5675
8.953333
9.235
9.94
10.535
10.65
10.97667
11.05333
11.45
11.6
11.65
11.78857
11.85
12.03333
12.3375
12.7
12.85
13.025
13.05
13.25
14.4
16
16.95
18.775
20.25

Number of samples		<u>Uncensored values</u>	
Uncensored	27	Mean	11.95
Censored	0	Lognormal mean	12.02
TOTAL	27	Std. devn.	3.46
		Median	11.7885714
		Min.	4.5
		Max.	20.25
Lognormal distribution?		Normal distribution?	
r-squared is: 0.90		r-squared is: 0.95	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Enter percentile	
L		90	
L = lognormal		Value corresponding to that percentile is:	
N = normal		50th	
X = neither (so use nonparametric method)		4 X 50th	
		Coefficient of Variation = 0.36	

MTCASat Background Calculations

5
6.1
6.6
7.6
8.8
9.1
9.11
10.8
10.8
11.4
12.6
15.4
16.1
17.9
18.3
20
29.3
35.9
36.9
38.4
71.3

Cr - GROUP "E"

REGIONS J,L,P,R - EASTERN WASHINGTON

Number of samples		<u>Uncensored values</u>	
Uncensored	21	Mean	18.92
Censored	0	Lognormal mean	18.74
TOTAL	21	Std. devn.	15.85
		Median	12.6
		Min.	5
		Max.	71.3
Lognormal distribution?		Normal distribution?	
r-squared is: 0.96		r-squared is: 0.75	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Value corresponding to that percentile is:	
L	Enter percentile	90	37.80
L = lognormal		50th	14.69
N = normal		4 X 50th	58.77
X = neither (so use nonparametric method)		Coefficient of Variation = 0.85	

MTCATStat Background Calculations
COPPER DATA

COPPER
STATEWIDE

Number of samples		<u>Uncensored values</u>	
Uncensored	166	Mean	20.46
Censored	0	Lognormal mean	19.75
TOTAL	166	Std. devn.	21.37
		Median	17.07
		Min.	4.00
		Max.	243.50
Lognormal distribution?		Normal distribution?	
r-squared is: 0.93		r-squared is: 0.41	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Value corresponding to that percentile is:	
L	Enter percentile	90	36.01 0.0000
L = lognormal		50th	16.80 0.0000
N = normal		4 X 50th	67.19 0.0000
X = neither (so use nonparametric method)		Coefficient of Variation = 0.65	

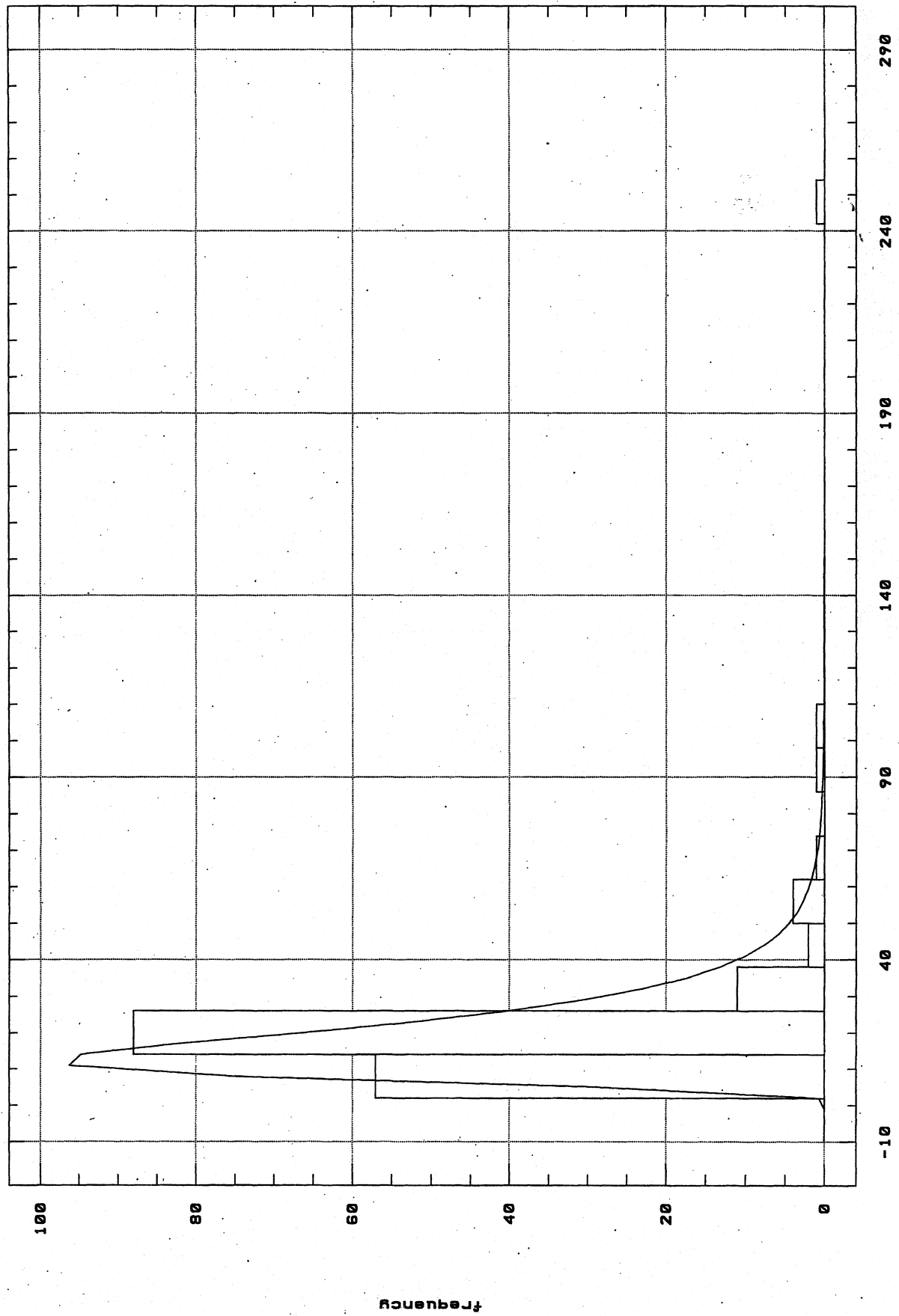
MTCATStat Background Calculations
COPPER DATA

14.45
14.6
14.6825
14.7
14.8
14.93333
15
15.23333
15.83538
15.8625
16
16
16.025
16.10714
16.2
16.3
16.35
16.4
17
17
17.13333
17.1625
17.3
17.3
17.56667
17.6
17.7
17.75
18
18.04286
18.1
18.15
18.25
18.55
18.55
18.61429
18.7
18.75
18.85
18.9
19.16667
19.5
19.6
19.63571
19.8
19.95
20.1
20.13333
20.2
20.3
20.5
20.65
20.7
21
21
21.03333
21.2
21.3
21.5
21.56667
21.9
22
22.33333
22.5

MTCATStat Background Calculations
COPPER DATA

22.8
23.05
23.2
23.3
23.33846
23.5
23.825
24.4
24.6
24.9
24.9
25
25
25.15
25.3
25.4
25.65
25.725
27.03333
27.06667
27.3
28.7
29.03333
29.2
29.24
29.65
30.96667
32.03077
33.9
39.25
42.84286
50.15
50.9
51.71429

STATEWIDE COPPER DISTRIBUTION



COPPER 90th = 36.0 MG/KG

MTCASat Background Calculations

4.33
4.4
5.04
5.18
5.2
6.23
7.2
8.05
18.7
22.5
23.2
24.4
33.9
50.9
99.4

Cu - GROUP "W"

REGIONS A,C,D - WESTERN WASHINGTON

Number of samples		<u>Uncensored values</u>	
Uncensored	15	Mean	21.24
Censored	0	Lognormal mean	21.14
TOTAL	15	Std. devn.	25.52
		Median	8.05
		Min.	4.33
		Max.	99.4
Lognormal distribution?		Normal distribution?	
r-squared is: 0.90		r-squared is: 0.68	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Value corresponding to that percentile is:	
L	Enter percentile	90	52.85
L = lognormal		50th	12.75
N = normal		4 X 50th	50.99
X = neither (so use nonparametric method)		Coefficient of Variation = 1.56	

MTCASat Background Calculations

Cu - CLARK COUNTY

9.71
10.695
11.95
12.795
13.95
14.23333
15.83538
17
17.56667
18.15
20.7
21.2
21.56667
22
23.05
23.3
23.33846
23.825
24.9
25
25.4
25.65
29.2
30.96667
39.25
51.71429

Number of samples		<u>Uncensored values</u>	
Uncensored	26	Mean	22.04
Censored	0	Lognormal mean	22.08
TOTAL	26	Std. devn.	9.06
		Median	21.7833333
		Min.	9.71
		Max.	51.7142857
Lognormal distribution?		Normal distribution?	
r-squared is: 0.97		r-squared is: 0.87	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Value corresponding	
L	Enter percentile	to that percentile is:	
L = lognormal	90	34.43	
N = normal	50th	20.49	
X = neither (so use nonparametric method)	4 X 50th	81.94	
	Coefficient of Variation = 0.42		

MTCASat Background Calculations

Cu - PUGET SOUND BASIN

4
7.59
8.846667
8.973333
9
10
10.8
10.84933
11.235
11.66667
11.75
11.85
12
12.5
13
13.75
13.86667
14
14
14.075
14.3
14.6825
15
16.10714
17
17.6
18
18.04286
19.16667
19.5
19.8
20.3
20.65
21
21
24.9
25
25.3
29.24
29.65
32.03077
42.84286
64.55
86.65
243.5

Number of samples		<u>Uncensored values</u>	
Uncensored	45	Mean	24.43
Censored	0	Lognormal mean	21.90
TOTAL	45	Std. devn.	36.38
		Median	15
		Min.	4
		Max.	243.5
Lognormal distribution?		Normal distribution?	
r-squared is: 0.86		r-squared is: 0.36	
Recommendations:			
Use nonparametric method.			
Enter distribution (L, N or X)		Value corresponding to that percentile is:	
X	Enter percentile	90	36.36
L = lognormal		50th	15.00
N = normal		4 X 50th	60.00
X = neither (so use nonparametric method)		Coefficient of Variation = N/A	

MTCASat Background Calculations

Cu - YAKIMA BASIN

4.125
12.4
13.3
15.23333
16.2
16.4
17.13333
17.1625
17.7
17.75
18.1
18.55
18.55
18.61429
18.75
18.85
19.6
19.63571
20.1
20.13333
20.5
21.03333
21.3
21.5
22.33333
22.8
23.5
24.6
25.15
27.03333
27.06667
50.15

Number of samples		<u>Uncensored values</u>	
Uncensored	32	Mean	20.16
Censored	0	Lognormal mean	20.38
TOTAL	32	Std. devn.	7.03
		Median	19.225
		Min.	4.125
		Max.	50.15
Lognormal distribution?		Normal distribution?	
r-squared is: 0.74		r-squared is: 0.73	
Recommendations:			
Use nonparametric method.			
Enter distribution (L, N or X)		Value corresponding to that percentile is:	
X	Enter percentile	90	26.47
L = lognormal		50th	19.23
N = normal		4 X 50th	76.90
X = neither (so use nonparametric method)		Coefficient of Variation = N/A	

MTCASat Background Calculations

Cu - SPOKANE BASIN

4.045
5.415
7.415
10.8
10.96
11.46667
11.85
12.95
13
13.05
13.30714
13.35
13.5
14.14333
14.4
14.45
14.45
14.93333
15.8625
16.025
16.3
17.3
17.3
18.25
19.95
25.725
29.03333

Number of samples		<u>Uncensored values</u>	
Uncensored	27	Mean	14.42
Censored	0	Lognormal mean	14.59
TOTAL	27	Std. devn.	5.19
		Median	14.1433333
		Min.	4.045
		Max.	29.0333333
Lognormal distribution?		Normal distribution?	
r-squared is: 0.87		r-squared is: 0.91	
Recommendations:			
Use normal distribution.			
Enter distribution (L, N or X)		Value corresponding to that percentile is:	
N	Enter percentile	90	21.61
L = lognormal		50th	14.42
N = normal		4 X 50th	57.66
X = neither (so use nonparametric method)		Coefficient of Variation = 0.39	

MTCASat Background Calculations

Cu - GROUP "E"

REGIONS J,L,P,R - EASTERN WASHINGTON

9.1
11.1
11.6
11.9
12.7
12.9
13.2
13.2
13.4
14.6
14.7
14.8
16
16
16.35
18.9
20.2
21.9
27.3
28.7
53

Number of samples		<u>Uncensored values</u>	
Uncensored	21	Mean	17.69
Censored	0	Lognormal mean	17.49
TOTAL	21	Std. devn.	9.53
		Median	14.7
		Min.	9.1
		Max.	53
Lognormal distribution?		Normal distribution?	
r-squared is: 0.87		r-squared is: 0.65	
Recommendations:			
Use nonparametric method.			
Enter distribution (L, N or X)		Value corresponding to that percentile is:	
X		Enter percentile	90
L = lognormal		50th	14.70
N = normal		4 X 50th	58.80
X = neither (so use nonparametric method)		Coefficient of Variation = N/A	

MTCASat Background Calculations
IRON DATA

IRON
STATEWIDE

Number of samples		<u>Uncensored values</u>	
Uncensored	165	Mean	25,903.72
Censored	0	Lognormal mean	25,835.70
TOTAL	165	Std. devn.	13,978.67
		Median	22,033.33
		Min.	5,025.00
		Max.	112,500.00
Lognormal distribution?		Normal distribution?	
r-squared is: 0.98		r-squared is: 0.83	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:
L		90	43,106.14 0.0000
L = lognormal		50th	22,987.15 0.0000
N = normal		4 X 50th	91,948.59 0.0000
X = neither (so use nonparametric method)		Coefficient of Variation = 0.52	

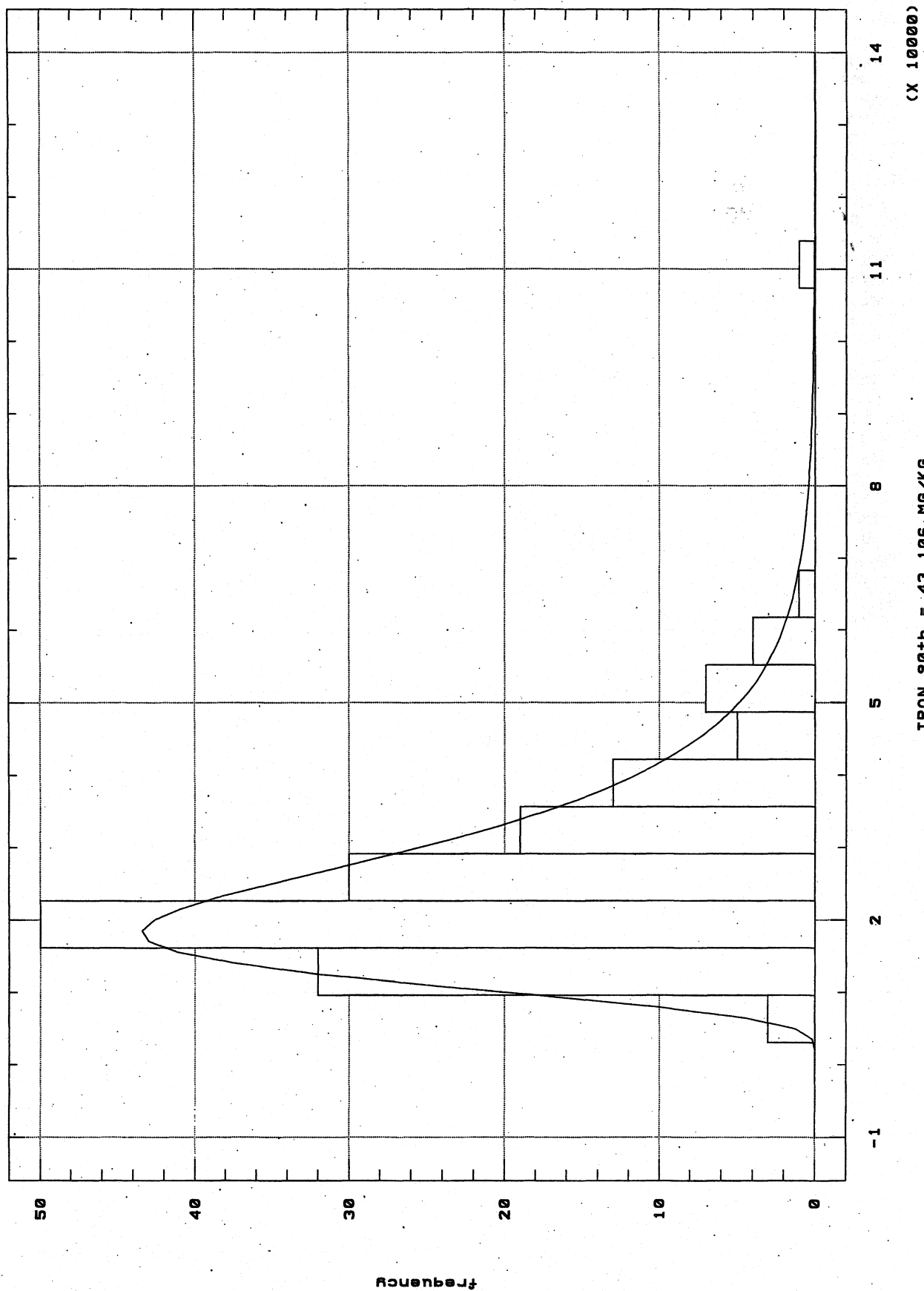
MTCASat Background Calculations
IRON DATA

18400
18400
19100
19450
19500
20000
20100
20200
20500
20525
20733.33
20800
21100
21225
21300
21350
21433.33
21633.33
21650
22033.33
22200
22300
22750
22900
23150
23300
23500
23900
24100
24550
24650
24700
24750
25000
25300
25850
26100
26100
26123.08
26200
26675
26900
27000
27071.43
27500
27700
27750
27800
28300
28642.86
29000
29040
29300
29300
30000
30050
30350
30600
30935.71
31400
31650
32600
32733.33
33000

MTCASat Background Calculations
IRON DATA

33100
33250
33350
33566.67
34500
35050
35450
35700
35933.33
37253.85
37450
37757.14
38400
39566.67
39600
39662.5
40400
41650
41700
41800
42200
42825
44700
45633.33
48625
49900
50200
52550
52850
53800
53933.33
54950
55571.43
58050

STATEWIDE IRON DISTRIBUTION



MTCASat Background Calculations

9160
11100
11300
13200
13900
14100
17100
18200
23300
26100
33000
38400
41800
49900
62800

Fe - GROUP "W"

REGIONS J,L,P,R - WESTERN WASHINGTON

Number of samples		<u>Uncensored values</u>	
Uncensored	15	Mean	25557.33
Censored	0	Lognormal mean	25757.52
TOTAL	15	Std. devn.	16247.65
		Median	18200
		Min.	9160
		Max.	62800

Lognormal distribution?	Normal distribution?
r-squared is: 0.96	r-squared is: 0.88

Recommendations:	
Use lognormal distribution.	

Enter distribution (L, N or X)	Enter percentile	Value corresponding to that percentile is:
L	90	49170.89
L = lognormal	50th	21446.18
N = normal	4 X 50th	85784.73
X = neither (so use nonparametric method)	Coefficient of Variation = 0.72	

MTCASat Background Calculations

Fe - CLARK COUNTY

16350
26123.08
29300
29300
31400
32733.33
33250
33350
35050
35700
35933.33
37253.85
37450
39566.67
41650
42200
42825
45633.33
48625
50200
52850
53933.33
54950
55571.43
58050
59850

Number of samples		<u>Uncensored values</u>	
Uncensored	26	Mean	40734.55
Censored	0	Lognormal mean	40923.09
TOTAL	26	Std. devn.	11005.31
		Median	38508.3333
		Min.	16350
		Max.	59850
Lognormal distribution?		Normal distribution?	
r-squared is: 0.93		r-squared is: 0.97	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Value corresponding to that percentile is:	
L	Enter percentile	90	58665.27
L = lognormal		50th	39180.95
N = normal		4 X 50th	156723.80
X = neither (so use nonparametric method)		Coefficient of Variation = 0.32	

MTCASat Background Calculations

Fe - PUGET SOUND BASIN

5920
11700
12320
12950
13050
13353.85
13450
13533.33
13700
14300
14333.33
14800
14900
15150
15300
15550
15660
16350
16550
16700
16800
17000
17100
17300
17650
17792.86
17900
18078.57
18200
19450
20100
20500
20525
21433.33
25850
26675
27500
27750
29040
34500
37757.14
40400
52550
112500

Number of samples		<u>Uncensored values</u>	
Uncensored	44	Mean	21680.05
Censored	0	Lognormal mean	21082.33
TOTAL	44	Std. devn.	16424.87
		Median	17050
		Min.	5920
		Max.	112500
Lognormal distribution?		Normal distribution?	
r-squared is: 0.85		r-squared is: 0.52	
Recommendations:			
Use nonparametric method.			
Enter distribution (L, N or X)		Value corresponding	
X	Enter percentile	90	to that percentile is:
L = lognormal		50th	36128.57
N = normal		4 X 50th	17050.00
X = neither (so use nonparametric method)			68200.00
		Coefficient of Variation = N/A	

MTCASat Background Calculations

Fe - YAKIMA BASIN

5025
16368.67
17200
20733.33
21350
21633.33
22033.33
22750
23150
23900
24550
26900
27071.43
27800
28300
28642.86
29000
30050
30350
30600
30935.71
31650
32600
33100
33566.67
35450
39600
39662.5
41700
44700
53800
58800

Number of samples		<u>Uncensored values</u>	
Uncensored	32	Mean	29780.40
Censored	0	Lognormal mean	30339.72
TOTAL	32	Std. devn.	10562.32
		Median	28821.4286
		Min.	5025
		Max.	58800
Lognormal distribution?		Normal distribution?	
r-squared is: 0.82		r-squared is: 0.94	
Recommendations:			
Use normal distribution.			
Enter distribution (L, N or X)		Value corresponding to that percentile is:	
L		Enter percentile	90
L = lognormal		50th	27689.82
N = normal		4 X 50th	110759.30
X = neither (so use nonparametric method)		Coefficient of Variation = 0.51	

MTCStat Background Calculations

Fe - SPOKANE BASIN

9670
12517.5
13966.67
14300
14662.5
16100
16133.33
16600
16735.71
17000
17050
17550
18150
18150
18400
18400
19500
20000
20800
21100
21225
22300
24100
24650
24750
25300
27000

Number of samples		<u>Uncensored values</u>	
Uncensored	27	Mean	18744.84
Censored	0	Lognormal mean	18783.35
TOTAL	27	Std. devn.	4172.08
		Median	18150
		Min.	9670
		Max.	27000
Lognormal distribution?		Normal distribution?	
r-squared is: 0.96		r-squared is: 0.98	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Value corresponding to that percentile is:	
L	Enter percentile	90	25026.20
L = lognormal		50th	18278.16
N = normal		4 X 50th	73112.65
X = neither (so use nonparametric method)		Coefficient of Variation = 0.25	

MTCASat Background Calculations

10400
11200
11500
13000
13200
15500
16200
17100
19100
20200
21300
21650
22200
22900
23500
24700
25000
26100
26200
27700
30000

Fe - GROUP "E"

REGIONS J,L,P,R - EASTERN WASHINGTON

Number of samples		<u>Uncensored values</u>	
Uncensored	21	Mean	19935.71
Censored	0	Lognormal mean	20046.16
TOTAL	21	Std. devn.	5885.98
		Median	21300
		Min.	10400
		Max.	30000
Lognormal distribution?		Normal distribution?	
r-squared is: 0.94		r-squared is: 0.97	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Value corresponding	
L	Enter percentile	90	to that percentile is:
L = lognormal		50th	29631.58
N = normal		4 X 50th	19027.40
X = neither (so use nonparametric method)			76109.59
		Coefficient of Variation = 0.36	

MTCASat Background Calculations
LEAD DATA

LEAD
STATEWIDE

Number of samples		<u>Uncensored values</u>	
Uncensored	151	Mean	10.05
Censored	15	Lognormal mean	9.26
TOTAL	166	Std. devn.	16.83
		Median	7.90
		Min.	2.10
		Max.	207.50
Lognormal distribution?		Normal distribution?	
r-squared is: 0.91		r-squared is: 0.23	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Value corresponding to that percentile is:	
L	Enter percentile	90	17.09 0.0000
L = lognormal		50th	6.98 0.0000
N = normal		4 X 50th	27.92 0.0000
X = neither (so use nonparametric method)		Coefficient of Variation = 0.79	

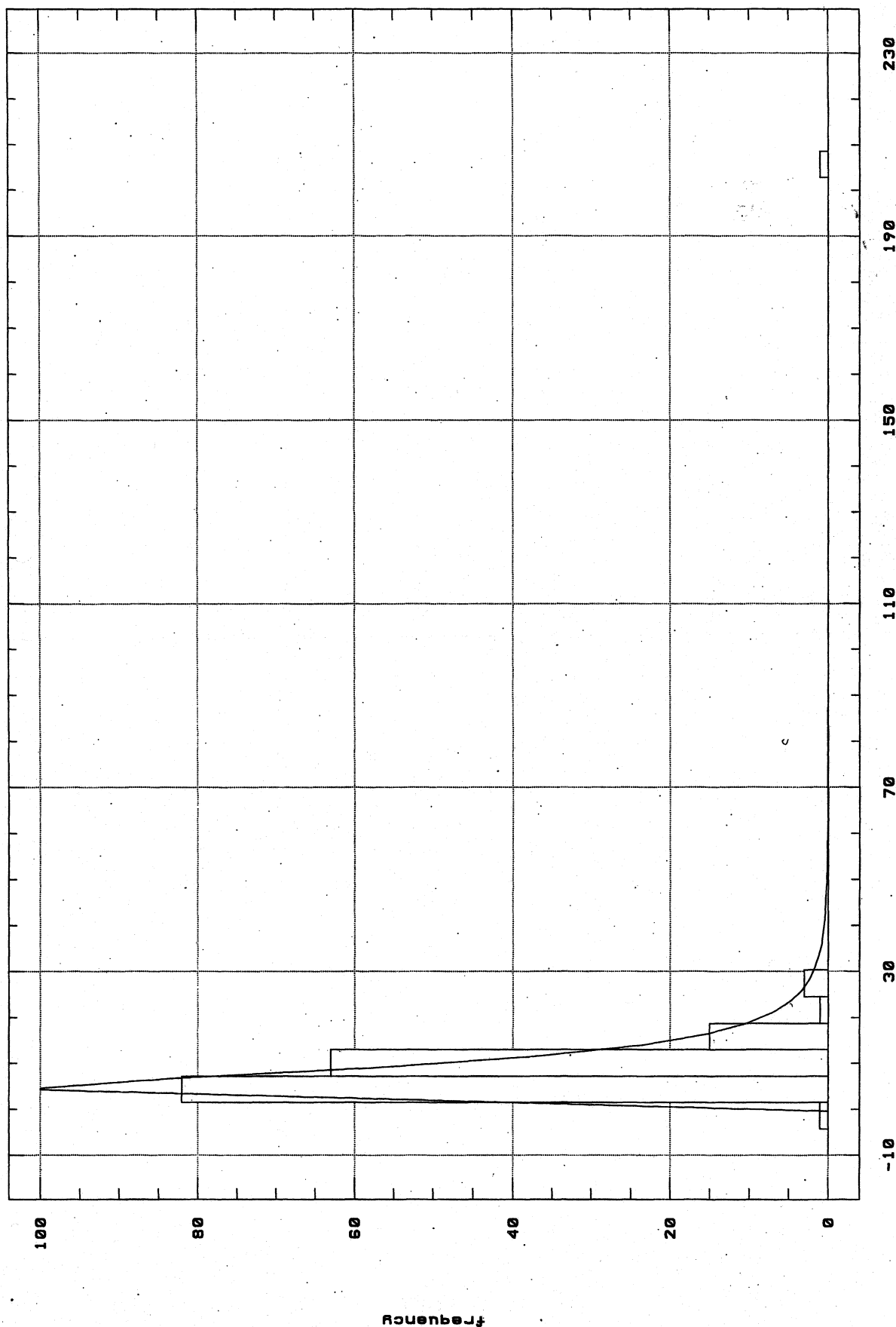
MTCASat Background Calculations
LEAD DATA

6.1
6.1
6.2
6.35
6.4
6.433333
6.5
6.521429
6.55
6.6
6.65
6.7
6.7
6.728571
6.75
6.8
6.866667
7
7.05
7.166667
7.3
7.3
7.4
7.45
7.7
7.8
7.85
7.9
8
8
8.1
8.2
8.25
8.3
8.35
8.65
8.666667
8.733333
8.75
8.8
8.8
9.05
9.1
9.133333
9.185
9.5
9.5
9.657143
9.7
9.7
9.8
9.9
9.9
10
10
10.05
10.15
10.26
10.4
10.5
10.6
10.65
10.65
10.73333

MTCASat Background Calculations
LEAD DATA

10.77143
10.8
10.875
10.975
11
11.09
11.3
11.5
11.7
12
12
12
12.04385
12.23333
12.5
12.5
12.8
12.83333
12.9
13.5
13.5
13.5
13.7
13.72667
14.33333
14.925
15
15.2
15.66667
15.77857
15.975
16
16.2
17.1

STATEWIDE LEAD DISTRIBUTION



LEAD 90th = 17.1 MG/KG

MTCASat Background Calculations

Pb - GROUP "W"

REGIONS A,C,D - WESTERN WASHINGTON

Number of samples		<u>Uncensored values</u>	
Uncensored	15	Mean	5.63
Censored	0	Lognormal mean	5.68
TOTAL	15	Std. devn.	3.52
		Median	4
		Min.	2.1
		Max.	12
Lognormal distribution?		Normal distribution?	
r-squared is: 0.94		r-squared is: 0.85	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Value corresponding to that percentile is:	
L	Enter percentile	90	10.87
L = lognormal		50th	4.75
N = normal		4 X 50th	18.98
X = neither (so use nonparametric method)		Coefficient of Variation = 0.72	

MTCASat Background Calculations

Pb - CLARK COUNTY

<2
4.65
5.45
5.5
6.7
7.3
7.45
7.7
8.3
8.65
8.733333
9.1
9.185
9.8
10.73333
10.77143
11.09
11.3
12.04385
12.23333
12.5
12.9
13.7
14.925
15.975
29.6

Number of samples		<u>Uncensored values</u>	
Uncensored	25	Mean	10.65
Censored	1	Lognormal mean	10.63
TOTAL	26	Std. devn.	4.93
		Median	9.8
		Min.	4.65
		Max.	29.6
Lognormal distribution?		Normal distribution?	
r-squared is: 0.95		r-squared is: 0.79	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Value corresponding to that percentile is:	
L	Enter percentile	90	16.83
L = lognormal		50th	9.50
N = normal		4 X 50th	37.99
X = neither (so use nonparametric method)		Coefficient of Variation = 0.47	

MTCASat Background Calculations

Pb - PUGET SOUND BASIN

Number of samples		<u>Uncensored values</u>	
Uncensored	31	Mean	15.88
Censored	14	Lognormal mean	12.39
TOTAL	45	Std. devn.	36.21
		Median	6.86666667
		Min.	2.125
		Max.	207.5
Lognormal distribution?		Normal distribution?	
r-squared is: 0.90		r-squared is: 0.37	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Value corresponding to that percentile is:	
L	Enter percentile	90	24.02
L = lognormal		50th	4.47
N = normal		4 X 50th	17.88
X = neither (so use nonparametric method)		Coefficient of Variation = 2.14	

MTCASat Background Calculations

Pb - YAKIMA BASIN

2.171429
3.875
4.066667
4.5
4.8625
5.133333
5.3
5.4
5.4
5.9
6.05
6.1
6.2
6.35
6.433333
6.5
6.55
6.65
6.728571
7
7.05
7.166667
7.3
7.4
7.85
8.1
8.25
9.133333
9.657143
9.7
15.2
17.1

Number of samples		<u>Uncensored values</u>	
Uncensored	32	Mean	7.03
Censored	0	Lognormal mean	7.04
TOTAL	32	Std. devn.	2.90
		Median	6.525
		Min.	2.17142857
		Max.	17.1
Lognormal distribution?		Normal distribution?	
r-squared is: 0.92		r-squared is: 0.80	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:
L		90	11.00
L = lognormal		50th	6.56
N = normal		4 X 50th	26.24
X = neither (so use nonparametric method)		Coefficient of Variation = 0.42	

MTCASat Background Calculations

Pb - SPOKANE BASIN

6.75
7.8
8.35
8.66667
8.75
8.8
9.05
9.5
10.05
10.5
10.6
10.65
10.65
10.8
10.875
11
11.5
12
12.5
12.8
12.83333
13.5
14.33333
15
15.66667
15.77857
16

Number of samples		<u>Uncensored values</u>	
Uncensored	27	Mean	11.29
Censored	0	Lognormal mean	11.30
TOTAL	27	Std. devn.	2.55
		Median	10.8
		Min.	6.75
		Max.	16
Lognormal distribution?		Normal distribution?	
r-squared is: 0.98		r-squared is: 0.97	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Value corresponding to that percentile is:	
L	Enter percentile 90	14.91	
L = lognormal	50th	11.01	
N = normal	4 X 50th	44.04	
X = neither (so use nonparametric method)		Coefficient of Variation = 0.24	

MTCAStat Background Calculations

Pb - GROUP "E"

REGIONS J.L.P,R - EASTERN WASHINGTON

4.2
4.2
4.8
5
5.3
5.4
5.8
5.9
5.95
6
6.4
6.6
6.7
6.8
8
8
8.8
9.5
9.9
10.4
11.7

Number of samples		<u>Uncensored values</u>	
Uncensored	21	Mean	6.92
Censored	0	Lognormal mean	6.93
TOTAL	21	Std. devn.	2.11
		Median	6.4
		Min.	4.2
		Max.	11.7
Lognormal distribution?		Normal distribution?	
r-squared is: 0.97		r-squared is: 0.93	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:
L		90	9.85
L = lognormal		50th	6.64
N = normal		4 X 50th	26.56
X = neither (so use nonparametric method)		Coefficient of Variation = 0.32	

MTCASat Background Calculations
MANGANESE DATA

MANGANESE

STATEWIDE DATA

Number of samples		<u>Uncensored values</u>	
Uncensored	166	Mean	592.56
Censored	0	Lognormal mean	595.61
TOTAL	166	Std. devn.	395.53
		Median	509.58
		Min.	78.00
		Max.	2,750.00
Lognormal distribution?		Normal distribution?	
r-squared is: 0.99		r-squared is: 0.82	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Value corresponding to that percentile is:	
L	90	1,094.85	1094.8454
L = lognormal	50th	492.82	1111.1408
N = normal	4 X 50th	1,971.30	1078.5499
X = neither (so use nonparametric method)		Coefficient of Variation = 0.69	

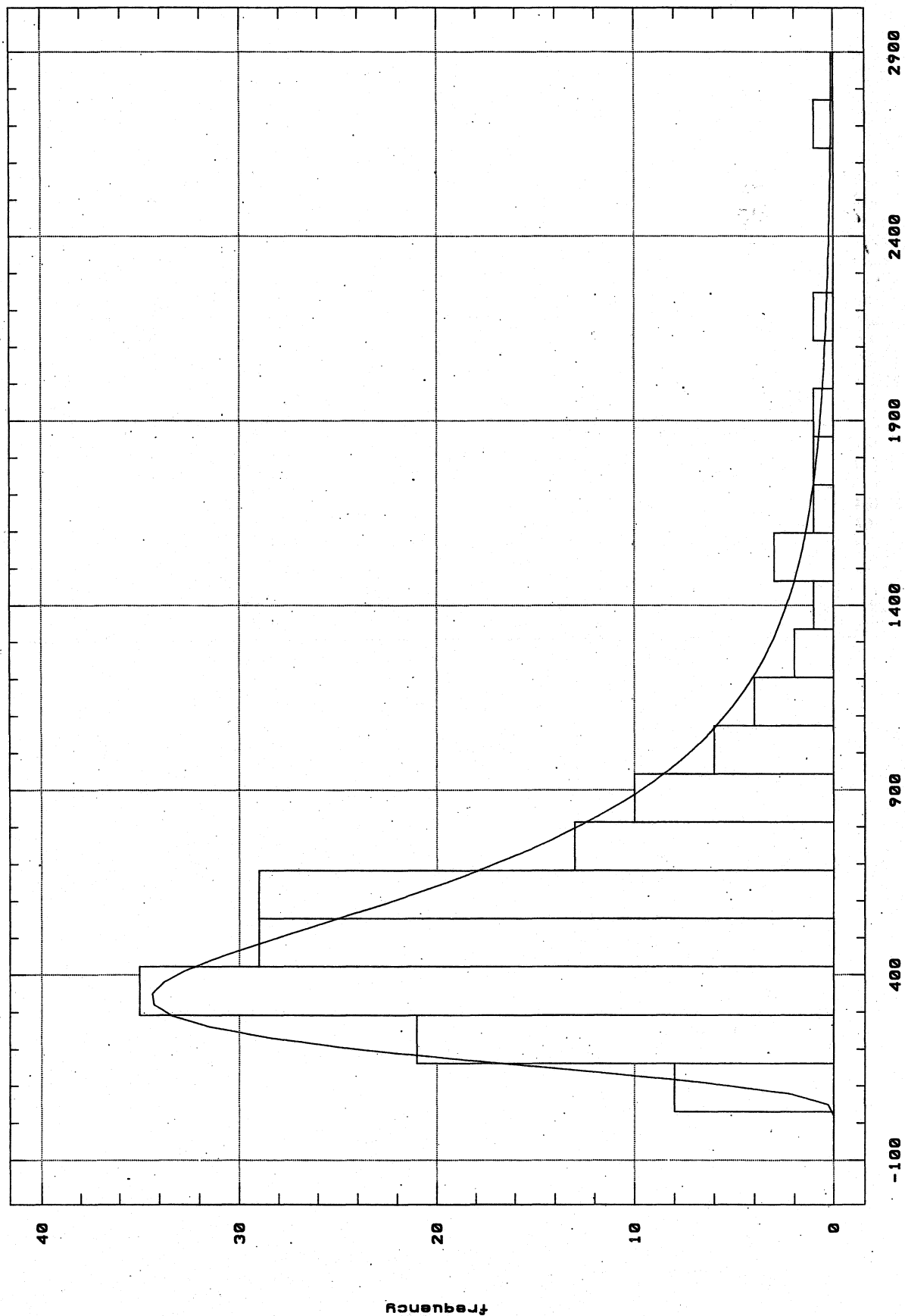
MTCASat Background Calculations
MANGANESE DATA

420.7692
427.6667
430
436
445.5
446
454
461
463.3333
464.6667
470
473.75
475
486
488
493.5
494.5
499
505
509.5
509.6667
510
516
520.5
523
523
525.5
537
540.5
547.3333
555
557.3333
557.5
558
561
561.25
564.4286
565.6667
571
577.75
591.6667
599
607
611
613
631
631
633
638.3571
638.5
652
655
659
659.9286
665.5
667.5
671
679.5
680
708.5
716
738
740
741.5

MTCASat Background Calculations
MANGANESE DATA

753.5
761
763
764.75
769.5
770.5
786.5
807.5
818.5
829.6667
840
846
848
902.5
904.5
926.5
927
930
951
951.6
952.5
983.75
1008
1042
1077.25
1110
1119
1192.154
1210.857
1291.5
1375
1483.333
1525.5
1546.125

STATEWIDE MANGNESE DISTRIBUTION



MANGNESE 90th = 1,095 MG/KG

MTCASat Background Calculations

Mn - GROUP "W"

REGIONS A,C,D - WESTERN WASHINGTON

Number of samples		<u>Uncensored values</u>	
Uncensored	15	Mean	329.27
Censored	0	Lognormal mean	335.74
TOTAL	15	Std. devn.	246.48
		Median	231
		Min.	78
		Max.	930
Lognormal distribution?		Normal distribution?	
r-squared is: 0.98		r-squared is: 0.86	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:
L		90	691.75
L = lognormal		50th	257.06
N = normal		4 X 50th	1028.24
X = neither (so use nonparametric method)		Coefficient of Variation = 0.9	

MTCAStat Background Calculations

Mn - CLARK COUNTY

150
231.5
420.7692
464.6667
509.5
659
665.5
667.5
807.5
829.6667
848
902.5
904.5
926.5
927
951
952.5
983.75
1042
1077.25
1110
1192.154
1483.333
1525.5
1836
1960.857

Number of samples		<u>Uncensored values</u>	
Uncensored	26	Mean	924.17
Censored	0	Lognormal mean	956.78
TOTAL	26	Std. devn.	432.53
		Median	915.5
		Min.	150
		Max.	1960.85714
Lognormal distribution?		Normal distribution?	
r-squared is: 0.89		r-squared is: 0.95	
Recommendations:			
Use normal distribution.			
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:
N		90	1511.59
L = lognormal		50th	924.17
N = normal		4 X 50th	3696.68
X = neither (so use nonparametric method)		Coefficient of Variation = 0.5	

MTCASat Background Calculations

Mn - PUGET SOUND BASIN

90
 141.4
 163
 183.6667
 216
 228.3333
 234.5
 252.75
 276.5
 284.3333
 299
 302.25
 306.5
 310.4
 321
 350.5714
 361.5
 365
 367.2143
 374.5
 383.3077
 387.5
 473.75
 499
 509.6667
 523
 525.5
 557.5
 561
 591.6667
 607
 659.9286
 679.5
 738
 740
 753.5
 763
 770.5
 818.5
 846
 951.6
 1291.5
 1670
 2170
 2750

Number of samples		<u>Uncensored values</u>	
Uncensored	45	Mean	592.21
Censored	0	Lognormal mean	584.83
TOTAL	45	Std. devn.	511.10
		Median	473.75
		Min.	90
		Max.	2750
Lognormal distribution?		Normal distribution?	
r-squared is: 0.98		r-squared is: 0.70	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:
L		90	1146.25
L = lognormal		50th	461.62
N = normal		4 X 50th	1846.48
X = neither (so use nonparametric method)		Coefficient of Variation = 0.81	

MTCAStat Background Calculations

Mn - YAKIMA BASIN

164.45
384.3333
386
392.5
396.5
427.6667
486
488
493.5
494.5
510
520.5
540.5
547.3333
564.4286
565.6667
613
631
638.3571
671
680
708.5
716
741.5
761
786.5
840
1008
1119
1210.857
1375
1546.125

Number of samples		<u>Uncensored values</u>	
Uncensored	32	Mean	668.99
Censored	0	Lognormal mean	672.23
TOTAL	32	Std. devn.	300.40
		Median	589.333333
		Min.	164.45
		Max.	1546.125
Lognormal distribution?		Normal distribution?	
r-squared is: 0.94		r-squared is: 0.87	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:
L		90	1104.84
L = lognormal		50th	611.46
N = normal		4 X 50th	2445.82
X = neither (so use nonparametric method)		Coefficient of Variation = 0.49	

MTCASat Background Calculations

Mn - SPOKANE BASIN

354.5
366
374
376.5
390.875
394.3333
417.4286
436
445.5
446
454
461
463.3333
470
475
505
555
557.3333
558
561.25
577.75
599
611
638.5
655
764.75
769.5

Number of samples		<u>Uncensored values</u>	
Uncensored	27	Mean	506.54
Censored	0	Lognormal mean	506.73
TOTAL	27	Std. devn.	114.86
		Median	470
		Min.	354.5
		Max.	769.5
Lognormal distribution?		Normal distribution?	
r-squared is: 0.97		r-squared is: 0.94	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:
L		90	663.48
L = lognormal		50th	494.78
N = normal		4 X 50th	1979.12
X = neither (so use nonparametric method)		Coefficient of Variation = 0.23	

MTCASat Background Calculations

Mn - GROUP "E"

REGIONS J,L,P,R - EASTERN WASHINGTON

Number of samples		<u>Uncensored values</u>	
Uncensored	21	Mean	364.95
Censored	0	Lognormal mean	365.18
TOTAL	21	Std. devn.	117.77
		Median	345
		Min.	233
		Max.	652

Lognormal distribution?	Normal distribution?
r-squared is: 0.96	r-squared is: 0.91

Recommendations:	
Use lognormal distribution.	

Enter distribution (L, N or X)	Enter percentile	Value corresponding to that percentile is:
L	90	526.59
L = lognormal	50th	348.73
N = normal	4 X 50th	1394.92
X = neither (so use nonparametric method)	Coefficient of Variation = 0.33	

MTCASat Background Calculations
MERCURY DATA

MERCURY
STATEWIDE DATA

Number of samples		<u>Uncensored values</u>	
Uncensored	166	Mean	0.03
Censored	0	Lognormal mean	0.03
TOTAL	166	Std. devn.	0.03
		Median	0.02
		Min.	0.00
		Max.	0.19
Lognormal distribution?		Normal distribution?	
r-squared is: 0.99		r-squared is: 0.80	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Value corresponding to that percentile is:	
L	90	0.07	0.0656
L = lognormal	50th	0.02	0.2486
N = normal	4 X 50th	0.09	-0.1174
X = neither (so use nonparametric method)		Coefficient of Variation = 1.02	

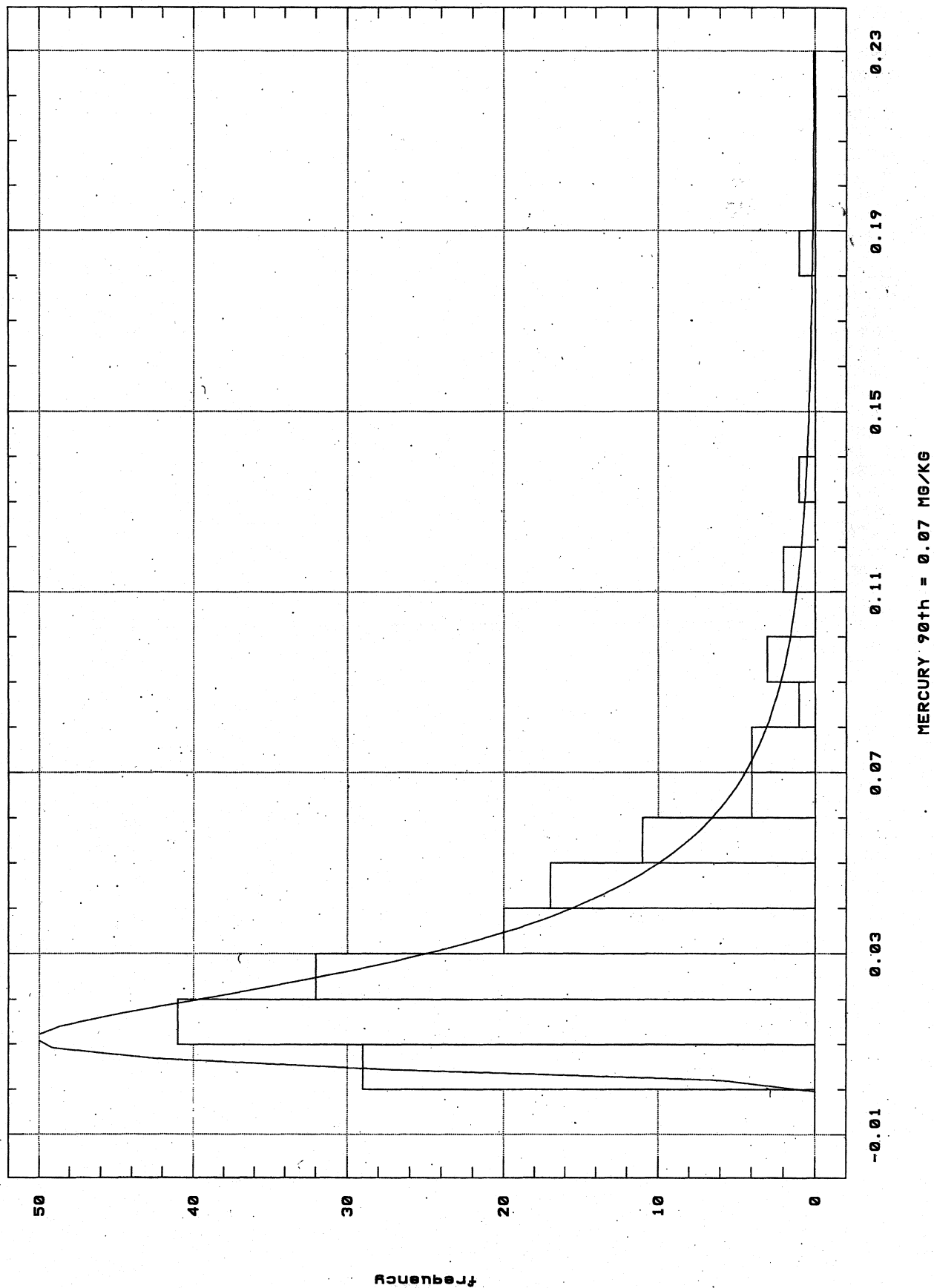
MTCASat Background Calculations
MERCURY DATA

0.0185
0.018914
0.019
0.0192
0.02
0.02
0.02
0.0205
0.0205
0.0205
0.021
0.021
0.021
0.021
0.0215
0.021667
0.021779
0.022
0.0225
0.023
0.024
0.025
0.0256
0.025846
0.0265
0.0265
0.026667
0.027
0.0275
0.02775
0.028
0.028333
0.0285
0.0285
0.0285
0.029
0.0292
0.03
0.03
0.0302
0.030333
0.030464
0.031
0.031
0.031
0.0315
0.032
0.033
0.03325
0.033333
0.0345
0.035
0.0356
0.035667
0.036
0.0365
0.037333
0.038
0.04
0.0406
0.042
0.042
0.0425
0.04265

MTCASat Background Calculations
MERCURY DATA

0.043
0.043457
0.0445
0.04475
0.045
0.045033
0.0455
0.046
0.047
0.0475
0.047931
0.04974
0.051
0.052
0.052
0.05325
0.053633
0.05485
0.055
0.05635
0.05675
0.058
0.06
0.061
0.0631
0.065725
0.066833
0.07435
0.07595
0.076
0.077308
0.082
0.093
0.09395

STATEWIDE MERCURY DISTRIBUTION



MTCASat Background Calculations

0.009
0.009
0.01
0.011
0.011
0.021
0.031
0.038
0.042
0.045
0.055
0.061
0.093
0.119
0.185

Hg - GROUP "W"

REGIONS A,C,D - WESTERN WASHINGTON

Number of samples		<u>Uncensored values</u>	
Uncensored	15	Mean	0.05
Censored	0	Lognormal mean	0.05
TOTAL	15	Std. devn.	0.05
		Median	0.038
		Min.	0.009
		Max.	0.185
Lognormal distribution?		Normal distribution?	
r-squared is: 0.94		r-squared is: 0.79	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Value corresponding	
L		Enter percentile	to that percentile is:
L = lognormal		90	0.13
N = normal		50th	0.03
X = neither (so use nonparametric method)		4 X 50th	0.13
		Coefficient of Variation = 1.47	

MTCASat Background Calculations

Hg - CLARK COUNTY

0.0125
0.01375
0.0192
0.02
0.02
0.02
0.0205
0.0205
0.0205
0.021
0.021667
0.022
0.0256
0.025846
0.026667
0.0285
0.0285
0.03
0.031
0.031
0.0315
0.033333
0.035
0.04
0.0425
0.0455
0.047931

Number of samples		<u>Uncensored values</u>	
Uncensored	26	Mean	0.03
Censored	0	Lognormal mean	0.03
TOTAL	26	Std. devn.	0.01
		Median	0.02625641
		Min.	0.0125
		Max.	0.04793077
Lognormal distribution?		Normal distribution?	
r-squared is: 0.97		r-squared is: 0.95	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Value corresponding to that percentile is:	
L	Enter percentile	90	0.04
L = lognormal		50th	0.03
N = normal		4 X 50th	0.10
X = neither (so use nonparametric method)		Coefficient of Variation = 0.37	

MTCASat Background Calculations

Hg - PUGET SOUND BASIN

0.012
0.021779
0.0265
0.027
0.02775
0.028
0.0285
0.029
0.0292
0.03
0.0302
0.033
0.03325
0.0356
0.036
0.0365
0.037333
0.042
0.04265
0.043
0.043457
0.0445
0.04475
0.045033
0.046
0.047
0.0475
0.04974
0.052
0.052
0.05325
0.053633
0.05485
0.05635
0.05675
0.058
0.06
0.0631
0.065725
0.066833
0.07595
0.076
0.077308
0.09395
0.094407

Number of samples		<u>Uncensored values</u>	
Uncensored	45	Mean	0.05
Censored	0	Lognormal mean	0.05
TOTAL	45	Std. devn.	0.02
		Median	0.04475
		Min.	0.012
		Max.	0.09440714
Lognormal distribution?		Normal distribution?	
r-squared is: 0.97		r-squared is: 0.95	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Value corresponding to that percentile is:	
L	Enter percentile	90	0.07
L = lognormal		50th	0.04
N = normal		4 X 50th	0.17
X = neither (so use nonparametric method)		Coefficient of Variation = 0.44	

MTCAStat Background Calculations

Hg - YAKIMA BASIN

0.00725
0.01
0.0105
0.011
0.011
0.0123
0.014
0.0155
0.016
0.016143
0.0165
0.017
0.017333
0.017714
0.018914
0.0205
0.021
0.023
0.024
0.0265
0.0275
0.028333
0.030333
0.030464
0.032
0.0345
0.035667
0.0406
0.051
0.07435
0.082
0.1165

Number of samples		<u>Uncensored values</u>	
Uncensored	32	Mean	0.03
Censored	0	Lognormal mean	0.03
TOTAL	32	Std. devn.	0.02
		Median	0.02075
		Min.	0.00725
		Max.	0.1165
Lognormal distribution?		Normal distribution?	
r-squared is: 0.96		r-squared is: 0.71	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)	Enter percentile	Value corresponding to that percentile is:	
L	90	0.05	
L = lognormal	50th	0.02	
N = normal	4 X 50th	0.09	
X = neither (so use nonparametric method)	Coefficient of Variation = 0.75		

MTCStat Background Calculations

Hg - SPOKANE BASIN

0.00425
0.00475
0.0054
0.00565
0.006164
0.00635
0.0065
0.008
0.009475
0.0105
0.01075
0.01195
0.012
0.01225
0.012667
0.014
0.014063
0.014333
0.014625
0.01625
0.0168
0.0172
0.0185
0.019
0.0215
0.0225
0.1312

Number of samples		<u>Uncensored values</u>	
Uncensored	27	Mean	0.02
Censored	0	Lognormal mean	0.02
TOTAL	27	Std. devn.	0.02
		Median	0.01225
		Min.	0.00425
		Max.	0.1312
Lognormal distribution?		Normal distribution?	
r-squared is: 0.85		r-squared is: 0.36	
Recommendations:			
Use nonparametric method.			
Enter distribution (L, N or X)		Enter percentile	
X		90	
L = lognormal		50th	
N = normal		4 X 50th	
X = neither (so use nonparametric method)		Coefficient of Variation = N/A	
		Value corresponding to that percentile is:	
		0.02	
		0.01	
		0.05	

MTCASat Background Calculations

Hg - GROUP "E"

REGIONS J,L,P,R - EASTERN WASHINGTON

0.004
0.004
0.004
0.004
0.004
0.004
0.004
0.004
0.005
0.0068
0.007
0.008
0.01
0.01
0.01
0.011
0.013
0.013
0.015
0.021
0.025

Number of samples		<u>Uncensored values</u>	
Uncensored	21	Mean	0.01
Censored	0	Lognormal mean	0.01
TOTAL	21	Std. devn.	0.01
		Median	0.007
		Min.	0.004
		Max.	0.025

Lognormal distribution?	Normal distribution?
r-squared is: 0.89	r-squared is: 0.82

Recommendations:	
Use nonparametric method.	

Enter distribution (L, N or X)	Enter percentile	Value corresponding to that percentile is:
X	90	0.02
L = lognormal	50th	0.01
N = normal	4 X 50th	0.03
X = neither (so use nonparametric method)	Coefficient of Variation = N/A	

MTCASat Background Calculations
NICKEL DATA

NICKEL

STATEWIDE DATA

Number of samples		<u>Uncensored values</u>			
Uncensored	166	Mean	21.49		
Censored	0	Lognormal mean	20.36		
TOTAL	166	Std. devn.	24.44		
		Median	16.43		
		Min.	2.15		
		Max.	244.50		
Lognormal distribution?		Normal distribution?			
r-squared is: 0.93		r-squared is: 0.44			
Recommendations:					
Use lognormal distribution.					
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:		
L		90	38.19	38.1907	
L = lognormal		50th	16.92	39.8195	
N = normal		4 X 50th	67.68	36.5618	
X = neither (so use nonparametric method)		Coefficient of Variation = 0.71			

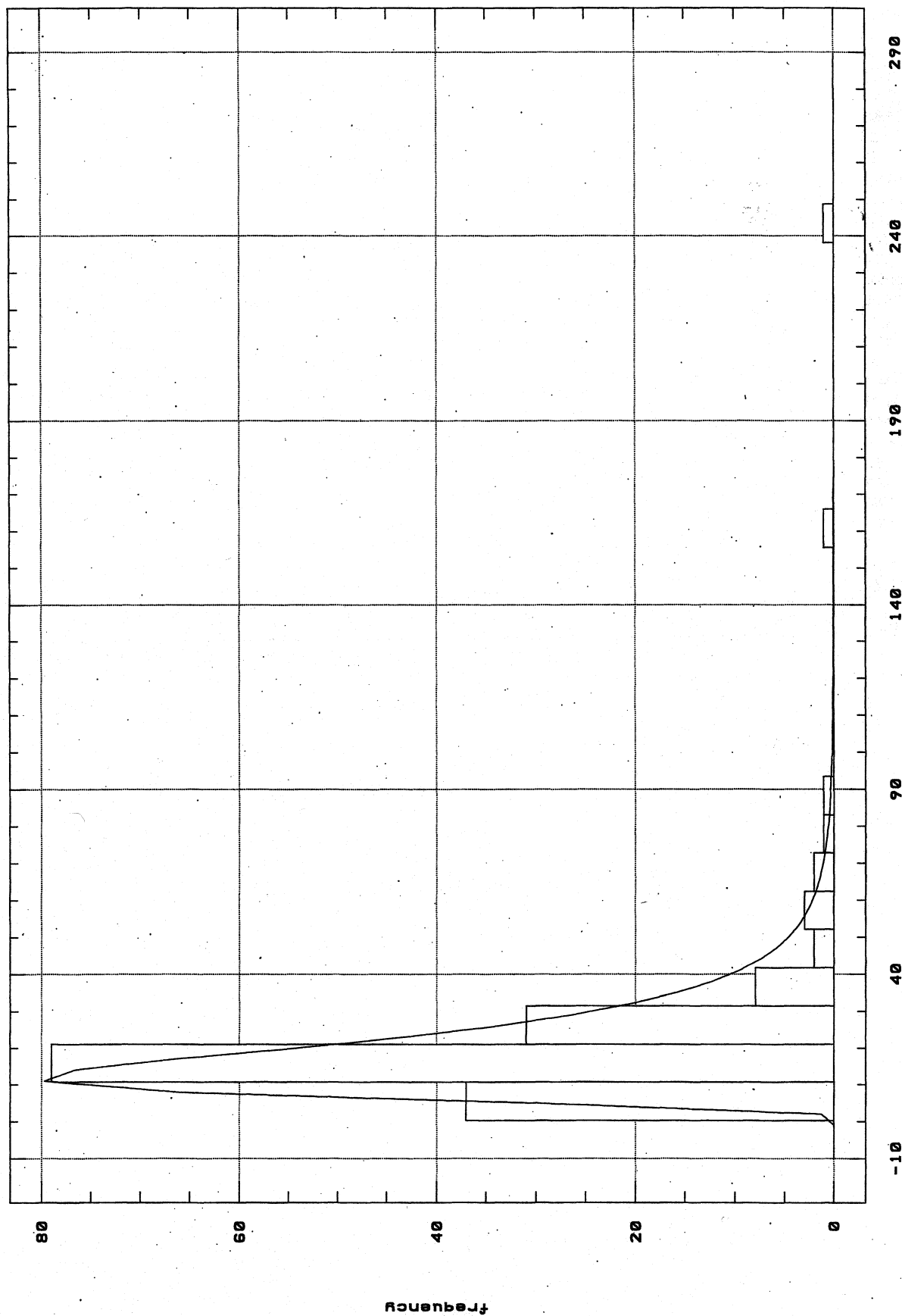
MTCASat Background Calculations
NICKEL DATA

13.76667
14
14.2
14.3
14.32857
14.53333
14.75
14.8
14.95
15.35
15.5
15.775
15.96667
16
16.06667
16.1
16.2
16.26667
16.35
16.4
16.46154
16.5
16.7
16.7
17
17
17.06667
17.3
17.35
17.4
17.4
17.975
18
18.17143
18.3
18.35
18.5
18.6
18.7
18.83333
18.9
19
19.05
19.1
19.1
19.1
19.3
19.3
19.4
19.6
20.26923
20.8
20.95
21.5
21.5
21.62857
21.7
22
22
22
22.13333
22.3
22.33333
22.75

MTCASat Background Calculations
NICKEL DATA

22.85
23
23
23.2
24
24
24.6
24.63333
24.66667
25
25
25.23333
25.24615
25.8
26.5
26.8
27.26667
28.95
29.9
31.3
34
34.1
34.95
36.3
36.86
38
39.8
40.36667
44.5
48.25
52.7
54.68571
57.45
63.2

STATEWIDE NICKEL DISTRIBUTION



MTCATStat Background Calculations

7.6
8.7
9
10
10.3
11.9
14.2
19.1
19.6
22.3
26.8
31.3
39.8
63.2
91.1

Ni - GROUP "W"

REGIONS "A", "C", "D"

Number of samples		<u>Uncensored values</u>	
Uncensored	15	Mean	25.66
Censored	0	Lognormal mean	25.38
TOTAL	15	Std. devn.	23.47
		Median	19.1
		Min.	7.6
		Max.	91.1
Lognormal distribution?		Normal distribution?	
r-squared is: 0.94		r-squared is: 0.74	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Value corresponding to that percentile is:	
L		Enter percentile	90
L = lognormal		50th	19.12
N = normal		4 X 50th	76.46
X = neither (so use nonparametric method)		Coefficient of Variation = 0.97	

MTCASat Background Calculations

Ni - CLARK COUNTY

7
9.35
12
12.6
12.65
12.75
13.55
13.76667
14.3
14.32857
14.75
15.96667
16.2
16.26667
16.46154
17.4
17.975
18.5
18.83333
18.9
19
19.05
19.3
20.26923
22.85
66.75

Number of samples		<u>Uncensored values</u>	
Uncensored	26	Mean	17.72
Censored	0	Lognormal mean	17.44
TOTAL	26	Std. devn.	10.61
		Median	16.2333333
		Min.	7
		Max.	66.75
Lognormal distribution?		Normal distribution?	
r-squared is: 0.79		r-squared is: 0.48	
Recommendations:			
Use nonparametric method.			
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:
X		90	21.04
L = lognormal		50th	16.23
N = normal		4 X 50th	64.93
X = neither (so use nonparametric method)		Coefficient of Variation = N/A	

MTCASat Background Calculations

Ni - PUGET SOUND BASIN

9
10.05
10.65
12.05
12.975
16
17
17.06667
17.35
18
18.17143
18.7
19.1
21.5
21.5
21.62857
21.7
22
22
22
22.33333
22.75
23
23
23.2
24
24.63333
24.66667
25
25
25.23333
25.24615
25.8
26.5
27.26667
29.9
34
34.95
36.3
36.86
44.5
52.7
54.68571
57.45
244.5

Number of samples		<u>Uncensored values</u>	
Uncensored	45	Mean	29.82
Censored	0	Lognormal mean	27.94
TOTAL	45	Std. devn.	34.45
		Median	23
		Min.	9
		Max.	244.5
Lognormal distribution?		Normal distribution?	
r-squared is: 0.83		r-squared is: 0.35	
Recommendations:			
Use nonparametric method.			
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:
X		90	47.78
L = lognormal		50th	23.00
N = normal		4 X 50th	92.00
X = neither (so use nonparametric method)		Coefficient of Variation = N/A	

MTCASat Background Calculations

Ni - YAKIMA BASIN

2.15
8.55
9.8
10.3
10.7
12.68571
12.9
13.25357
13.55
14.53333
14.8
14.95
15.35
15.5
16.06667
16.1
16.35
17.3
17.4
18.3
18.35
19.1
19.3
20.95
22.13333
24
28.95
38
40.36667
48.25
81.75714
163

Number of samples		<u>Uncensored values</u>	
Uncensored	32	Mean	24.83
Censored	0	Lognormal mean	23.73
TOTAL	32	Std. devn.	29.11
		Median	16.225
		Min.	2.15
		Max.	163
Lognormal distribution?		Normal distribution?	
r-squared is: 0.85		r-squared is: 0.49	
Recommendations:			
Use nonparametric method.			
Enter distribution (L, N or X)		Value corresponding to that percentile is:	
X	Enter percentile	90	45.89
L = lognormal		50th	16.23
N = normal		4 X 50th	64.90
X = neither (so use nonparametric method)		Coefficient of Variation = N/A	

MTCASat Background Calculations

Ni - SPOKANE BASIN

4.6
4.9
8.1
8.325
8.7
9.2
9.46667
9.65
9.75
9.8
9.85
9.875
10.03333
10.15
10.36643
10.85125
11.4
11.8
12.05
12.2
12.35
12.45
12.55
15.775
16.4
16.7
18.6

Number of samples		<u>Uncensored values</u>	
Uncensored	27	Mean	10.96
Censored	0	Lognormal mean	11.01
TOTAL	27	Std. devn.	3.20
		Median	10.15
		Min.	4.6
		Max.	18.6
Lognormal distribution?		Normal distribution?	
r-squared is: 0.90		r-squared is: 0.93	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Value corresponding to that percentile is:	
L	Enter percentile	90	16.19
L = lognormal		50th	10.49
N = normal		4 X 50th	41.96
X = neither (so use nonparametric method)		Coefficient of Variation = 0.35	

MTCASat Background Calculations

Ni - GROUP "E"

REGIONS J,L,P,R - EASTERN WASHINGTON

6.4
7.1
7.7
7.8
9.2
9.5
9.7
10.65
10.7
11.2
11.7
12.2
12.3
14
16.5
16.7
17
19.4
20.8
24.6
34.1

Number of samples		<u>Uncensored values</u>	
Uncensored	21	Mean	13.77
Censored	0	Lognormal mean	13.75
TOTAL	21	Std. devn.	6.71
		Median	11.7
		Min.	6.4
		Max.	34.1
Lognormal distribution?		Normal distribution?	
r-squared is: 0.97		r-squared is: 0.85	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Value corresponding to that percentile is:	
L	Enter percentile	90	22.41
L = lognormal		50th	12.54
N = normal		4 X 50th	50.14
X = neither (so use nonparametric method)		Coefficient of Variation = 0.48	

MTCASat Background Calculations
ZINC DATA

ZINC

STATEWIDE DATA

12
21.1
21.4
24.1
24.4
24.43333
24.6
26.3
27.5
28.6
28.66667
29
29.7
30.3
30.7
31
31.4
31.5
32.3
32.3
32.4
32.7
33
33.25
33.95
34
35.8
36.3
36.7
37.4
38
38
39
39.26667
39.4
39.6
39.7
40.61429
40.85
41
41.03333
41.05
41.7
42
42.2
42.4
42.4875
42.5
43
43.2
43.35
43.6
43.65
43.75
43.8
43.95385
44.05
44.25
44.3
44.3
44.5
44.5
44.7

Number of samples		<u>Uncensored values</u>	
Uncensored	166	Mean	55.53
Censored	0	Lognormal mean	55.68
TOTAL	166	Std. devn.	21.55
		Median	51.12
		Min.	12.00
		Max.	132.50
Lognormal distribution?		Normal distribution?	
r-squared is: 0.99		r-squared is: 0.95	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Value corresponding	
L	Enter percentile	to that percentile is:	
L = lognormal	90	85.82	85.8205
N = normal	50th	51.56	87.3942
X = neither (so use nonparametric method)	4 X 50th	206.23	84.2468
	Coefficient of Variation = 0.41		

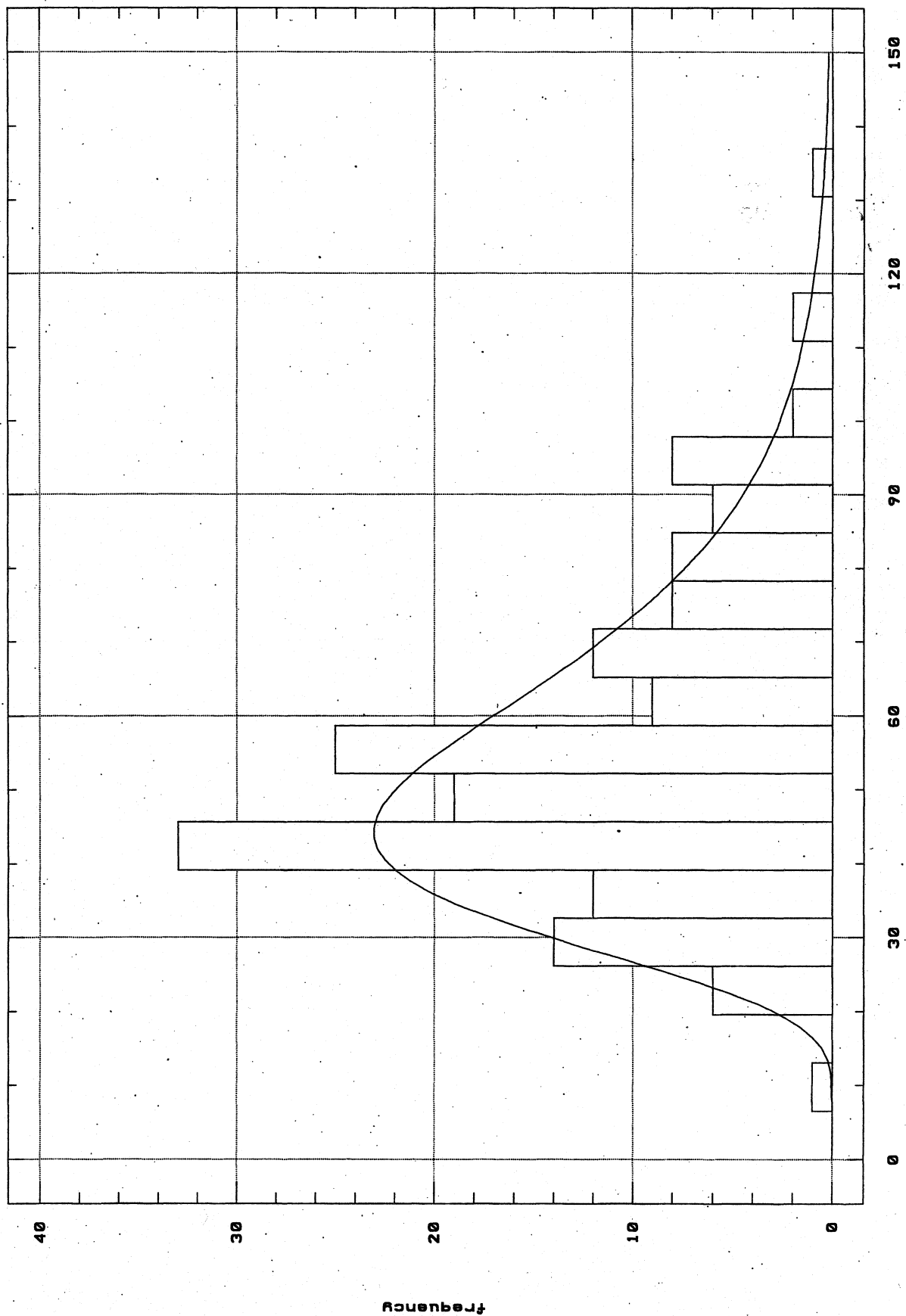
MTCASat Background Calculations
ZINC DATA

45
45.15
45.55
45.7
46.15
46.3
46.6
46.8
47.1
47.23333
47.575
47.65
47.95
48.15
48.50714
49.4
49.72143
50.35
50.4
50.89286
51.35
51.8
52.35
52.56667
52.575
52.7
53.05
53.3
53.35
53.6
53.8
53.9
54
54.15
54.6
54.75
55.65
55.9
56
56
56.4
56.85
58
58
58.3
58.45
58.46429
60.3
60.6
60.7
61.325
61.8
62.9125
63
63.1
64.3
66.15
67.1
67.16667
67.45
67.86667
68.1
68.4
69.45

MTCASat Background Calculations
ZINC DATA

70.8
71
71
71.38571
74.9
75.2
75.4
76.4
77.1
77.43333
77.9
78.1
78.85
79.9
81.45
82
82.3
83.8
84.5
84.68462
86
89.33333
89.4
89.51538
90.5
90.7
92.1
92.2
92.5
93
94.17143
94.75
97.3
97.7

STATEWIDE ZINC DISTRIBUTION



MTCASat Background Calculations

21.1
24.1
24.4
24.6
27.5
36.7
42.4
44.5
45
53.8
54
63
63.1
86
116

Zn - GROUP "W"

REGIONS A,C,D - WESTERN WASHINGTON

Number of samples		<u>Uncensored values</u>	
Uncensored	15	Mean	48.41
Censored	0	Lognormal mean	48.66
TOTAL	15	Std. devn.	26.17
		Median	44.5
		Min.	21.1
		Max.	116
Lognormal distribution?		Normal distribution?	
r-squared is: 0.96		r-squared is: 0.87	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Value corresponding	
L	Enter percentile	to that percentile is:	
L = lognormal	90	85.56	
N = normal	50th	42.85	
X = neither (so use nonparametric method)	4 X 50th	171.39	
	Coefficient of Variation = 0.58		

MTCASat Background Calculations

Zn - CLARK COUNTY

21.4
33.95
56.85
58
64.3
66.15
67.1
67.86667
69.45
71.38571
74.9
76.4
77.1
79.9
83.8
84.5
84.68462
89.33333
89.51538
92.1
92.2
92.5
93
94.75
97.3
97.7

Number of samples		<u>Uncensored values</u>	
Uncensored	26	Mean	76.01
Censored	0	Lognormal mean	77.04
TOTAL	26	Std. devn.	18.79
		Median	78.5
		Min.	21.4
		Max.	97.7
Lognormal distribution?		Normal distribution?	
r-squared is: 0.72		r-squared is: 0.88	
Recommendations:			
Use nonparametric method.			
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:
X		90	95.52
L = lognormal		50th	78.50
N = normal		4 X 50th	314.00
X = neither (so use nonparametric method)		Coefficient of Variation = N/A	

MTCASat Background Calculations

Zn - PUGET SOUND BASIN

12
24.43333
28.6
28.66667
29
31
32.3
32.3
32.7
33
33.25
34
35.8
36.3
38
38
39
40.61429
41.7
42.5
43
43.35
43.65
43.95385
44.5
45.15
46.8
47.65
52.35
52.575
54.15
54.6
56
58
58.45
67.16667
71
78.1
81.45
82
89.4
90.5
99
116.75
132.5

Number of samples		<u>Uncensored values</u>	
Uncensored	45	Mean	51.45
Censored	0	Lognormal mean	51.50
TOTAL	45	Std. devn.	24.93
		Median	43.65
		Min.	12
		Max.	132.5
Lognormal distribution?		Normal distribution?	
r-squared is: 0.95		r-squared is: 0.86	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Value corresponding to that percentile is:	
L	Enter percentile	90	85.06
L = lognormal		50th	46.52
N = normal		4 X 50th	186.08
X = neither (so use nonparametric method)		Coefficient of Variation = 0.5	

MTCASat Background Calculations

Zn - YAKIMA BASIN

39.26667
40.85
41.03333
43.6
43.75
44.3
44.7
45.55
45.7
46.6
47.23333
48.50714
49.72143
50.4
51.35
52.7
53.05
53.6
54.75
55.9
58.46429
60.3
60.6
60.7
62.9125
68.1
75.2
77.43333
78.85
90.7
94.17143
101.4333

Number of samples		<u>Uncensored values</u>	
Uncensored	32	Mean	57.54
Censored	0	Lognormal mean	57.48
TOTAL	32	Std. devn.	16.18
		Median	52.875
		Min.	39.2666667
		Max.	101.433333
Lognormal distribution?		Normal distribution?	
r-squared is: 0.93		r-squared is: 0.86	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Value corresponding to that percentile is:	
L	Enter percentile	90	78.71
L = lognormal		50th	55.66
N = normal		4 X 50th	222.65
X = neither (so use nonparametric method)		Coefficient of Variation = 0.28	

MTCASat Background Calculations

Zn - SPOKANE BASIN

29.7
41.05
42
42.4875
43.2
44.05
44.25
44.3
46.15
46.3
47.575
48.15
50.35
50.89286
51.8
52.56667
53.3
53.35
53.9
55.65
56
61.325
61.8
67.45
68.4
70.8
71

Number of samples		<u>Uncensored values</u>	
Uncensored	27	Mean	51.77
Censored	0	Lognormal mean	51.82
TOTAL	27	Std. devn.	10.03
		Median	50.8928571
		Min.	29.7
		Max.	71
Lognormal distribution?		Normal distribution?	
r-squared is: 0.95		r-squared is: 0.95	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Value corresponding to that percentile is:	
L		Enter percentile	90
L = lognormal		50th	50.83
N = normal		4 X 50th	203.33
X = neither (so use nonparametric method)		Coefficient of Variation = 0.21	

MTCASat Background Calculations

26.3
30.3
30.7
31.4
31.5
32.4
37.4
39.4
39.6
39.7
41
42.2
43.8
47.1
47.95
49.4
56.4
58.3
75.4
77.9
82.3

Zn - GROUP "E"

REGIONS J,L,P,R - EASTERN WASHINGTON

Number of samples		<u>Uncensored values</u>	
Uncensored	21	Mean	45.74
Censored	0	Lognormal mean	45.73
TOTAL	21	Std. devn.	16.11
		Median	41
		Min.	26.3
		Max.	82.3
Lognormal distribution?		Normal distribution?	
r-squared is: 0.95		r-squared is: 0.87	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Value corresponding	
L	Enter percentile	to that percentile is:	
L = lognormal	90	67.47	
N = normal	50th	43.40	
X = neither (so use nonparametric method)	4 X 50th	173.60	
	Coefficient of Variation =	0.35	

MTCASat Background Calculations

* Ag - STATEWIDE

ALL DATA

* Background calculation based on values exceeding detection limit

Number of samples		<u>Uncensored values</u>	
Uncensored	33	Mean	0.43
Censored	0	Lognormal mean	0.43
TOTAL	33	Std. devn.	0.13
		Median	0.37
		Min.	0.24
		Max.	0.75
Lognormal distribution?		Normal distribution?	
r-squared is: 0.91		r-squared is: 0.84	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:
L		90	0.61
L = lognormal		50th	0.41
N = normal		4 X 50th	1.64
X = neither (so use nonparametric method)		Coefficient of Variation = 0.31	

MTCASat Background Calculations
BARIUM DATA

Ba - SPOKANE BASIN

ALL DATA

Number of samples		<u>Uncensored values</u>	
Uncensored	72	Mean	164.29
Censored	0	Lognormal mean	164.87
TOTAL	72	Std. devn.	63.96
		Median	157.5
		Min.	47.6
		Max.	471
Lognormal distribution?		Normal distribution?	
r-squared is: 0.95		r-squared is: 0.87	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:
L		90	254.97
L = lognormal		50th	153.28
N = normal		4 X 50th	613.11
X = neither (so use nonparametric method)		Coefficient of Variation = 0.41	

NOTE: Ba DATA COLLECTED IN SPOKANE BASIN ONLY. BACKGROUND VALUE MAY NOT BE REPRESENTATIVE OF STATEWIDE CONCENTRATIONS.

MTCASat Background Calculations
BARIUM DATA

210
213
232
242
266
280
293
326
471

MTCASat Background Calculations
CALCIUM DATA

Ca - SPOKANE BASIN

ALL DATA

Number of samples		<u>Uncensored values</u>	
Uncensored	72	Mean	9185.53
Censored	0	Lognormal mean	5216.31
TOTAL	72	Std. devn.	28877.71
		Median	3265
		Min.	888
		Max.	180000
Lognormal distribution?		Normal distribution?	
r-squared is: 0.63		r-squared is: 0.23	
Recommendations:			
Use nonparametric method.			
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:
X		90	5493.00
L = lognormal		50th	3210.00
N = normal		4 X 50th	12840.00
X = neither (so use nonparametric method)		Coefficient of Variation = N/A	

NOTE: Ca DATA COLLECTED IN SPOKANE BASIN ONLY. BACKGROUND VALUE MAY NOT BE REPRESENTATIVE OF STATEWIDE CONCENTRATIONS.

MTCASat Background Calculations
CALCIUM DATA

4810
5290
5580
6730
7140
13800
117000
135000
180000

MTCASat Background Calculations
COBALT DATA

Co - SPOKANE BASIN

ALL DATA

Number of samples		<u>Uncensored values</u>	
Uncensored	72	Mean	7.82
Censored	0	Lognormal mean	7.82
TOTAL	72	Std. devn.	2.52
		Median	7.365
		Min.	3.29
		Max.	19.2

Lognormal distribution?	Normal distribution?
r-squared is: 0.98	r-squared is: 0.90

Recommendations:	
Use lognormal distribution.	

Enter distribution (L, N or X)	Enter percentile	Value corresponding to that percentile is:
L	90	11.15
L = lognormal	50th	7.47
N = normal	4 X 50th	29.88
X = neither (so use nonparametric method)	Coefficient of Variation = 0.32	

NOTE: Co DATA COLLECTED IN SPOKANE BASIN ONLY. BACKGROUND VALUE MAY NOT BE REPRESENTATIVE OF STATEWIDE CONCENTRATIONS.

MTCASat Background Calculations
COBALT DATA

10.5
10.6
10.7
11.4
12.1
12.3
12.4
13.4
19.2

MTCASat Background Calculations
MAGNESIUM DATA

Mg - SPOKANE BASIN

ALL DATA

Number of samples		<u>Uncensored values</u>	
Uncensored	69	Mean	244.01
Censored	0	Lognormal mean	209.37
TOTAL	69	Std. devn.	442.14
		Median	176
		Min.	72.8
		Max.	3520
Lognormal distribution?		Normal distribution?	
r-squared is: 0.78		r-squared is: 0.26	
Recommendations:			
Use nonparametric method.			
Enter distribution (L, N or X)		Value corresponding to that percentile is:	
X		Enter percentile	90
L = lognormal			298.00
N = normal		50th	175.00
X = neither (so use nonparametric method)		4 X 50th	700.00
		Coefficient of Variation = N/A	

NOTE: Mg DATA COLLECTED IN SPOKANE BASIN ONLY. BACKGROUND VALUE MAY NOT BE REPRESENTATIVE OF STATEWIDE CONCENTRATIONS.

MTCASat Background Calculations
MAGNESIUM DATA

354
368
397
468
1602
3520

MTCASat Background Calculations

* Sb - STATEWIDE

ALL DATA

* BACKGROUND CALCULATION BASED ON VALUES EXCEEDING DETECTION LIMIT

Number of samples		<u>Uncensored values</u>	
Uncensored	50	Mean	4.10
Censored	0	Lognormal mean	4.10
TOTAL	50	Std. devn.	0.87
		Median	4
		Min.	3.1
		Max.	7.6
Lognormal distribution?		Normal distribution?	
r-squared is: 0.91		r-squared is: 0.82	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:
L		90	5.20
L = lognormal		50th	4.02
N = normal		4 X 50th	16.10
X = neither (so use nonparametric method)		Coefficient of Variation = 0.2	

MTCASat Background Calculations

0.4
0.41
0.44
0.45
0.47
0.51
0.51
0.54
0.59
0.62
0.74
0.74
0.77
0.84

*** SELENIUM**

*** STATEWIDE DATA - BACKGROUND CALCULATION BASED ON THOSE VALUES
EXCEEDING DETECTION LIMIT ("AA" ANALYSIS)**

Number of samples		<u>Uncensored values</u>	
Uncensored	14	Mean	0.57
Censored	0	Lognormal mean	0.57
TOTAL	14	Std. devn.	0.15
		Median	0.525
		Min.	0.4
		Max.	0.84
Lognormal distribution?		Normal distribution?	
r-squared is: 0.95		r-squared is: 0.92	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Value corresponding to that percentile is:	
L		Enter percentile	90
L = lognormal		50th	0.56
N = normal		4 X 50th	2.23
X = neither (so use nonparametric method)		Coefficient of Variation = 0.27	

MTCASat Background Calculations
TITANIUM DATA

Ti - SPOKANE BASIN

ALL DATA

Number of samples		<u>Uncensored values</u>	
Uncensored	72	Mean	681.60
Censored	0	Lognormal mean	683.68
TOTAL	72	Std. devn.	311.17
		Median	631.5
		Min.	131
		Max.	2130
Lognormal distribution?		Normal distribution?	
r-squared is: 0.94		r-squared is: 0.82	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:
L		90	1109.73
L = lognormal		50th	623.62
N = normal		4 X 50th	2494.48
X = neither (so use nonparametric method)		Coefficient of Variation = 0.47	

NOTE: TI DATA COLLECTED IN SPOKANE BASIN ONLY. BACKGROUND VALUE MAY NOT BE REPRESENTATIVE OF STATEWIDE CONCENTRATIONS.

MTCASat Background Calculations
TITANIUM DATA

903
910
1120
1270
1290
1320
1370
1550
2130

MTCASat Background Calculations
VANADIUM DATA

V - SPOKANE BASIN

ALL DATA

Number of samples		<u>Uncensored values</u>	
Uncensored	72	Mean	28.15
Censored	0	Lognormal mean	28.06
TOTAL	72	Std. devn.	13.57
		Median	24.25
		Min.	8.23
		Max.	80.5
Lognormal distribution?		Normal distribution?	
r-squared is: 0.98		r-squared is: 0.86	
Recommendations:			
Use lognormal distribution.			
Enter distribution (L, N or X)		Enter percentile	Value corresponding to that percentile is:
L		90	45.04
L = lognormal		50th	25.56
N = normal		4 X 50th	102.25
X = neither (so use nonparametric method)		Coefficient of Variation = 0.46	

NOTE: VANADIUM DATA COLLECTED IN SPOKANE BASIN ONLY. BACKGROUND VALUE MAY NOT BE REPRESENTATIVE OF STATEWIDE CONCENTRATIONS.

MTCASat Background Calculations
VANADIUM DATA

39
39.4
40.2
42.3
43.1
48.5
49.4
57
59.8
60.2
66.2
80.5

XII. DATA QUALITY INFORMATION

Data Quality Assurance and Quality Control (QA/QC)

Information on the overall quality of the data used in this report is presented in this section. The background soil data presented in this report is based on analytical work performed by the Department of Ecology's Manchester Environmental Laboratory. Four primary methods or procedures are employed by Manchester to evaluate and control the accuracy of laboratory analyses: check standards, duplicates, spikes, and blanks. The check standard is routinely performed in the laboratory using lab control samples and spiked blanks. The most important of the quality control measures is the check standard, followed by duplicate samples.

Sample Splits, Duplicates, and Reference Samples

Sample splits, duplicates, and reference samples were periodically collected in each phase of this study. The sample preparation method outlined in ASTM D 3987-85 was used to prepare all sample splits and duplicates. In addition to sample splits and duplicates, reference samples were also collected. Reference samples were collected from a separate geographic location and included in another data set for analysis. For example, the two reference samples in the Puget Sound data base were actually collected in Walla Walla. These samples were labeled as coming from the Puget Sound data set for QA/QC purposes. Additional information on sample splits and duplicates is given in Table 18.

Table 18: Sample Splits, Duplicates, and Reference Samples

Study	Date	Sampling Locations	Splits	Duplicates	Reference Samples	Total No. Samples
Soos Creek	1987	18	0	4		41
Other Regions ¹	1990	35	0	0		35
Clark County ²	1991	26	5	0	2	86
Yakima ³	1991	32	7	0	2	117
Spokane ⁴	1992	27	9	0		84
Puget Sound ⁵	1993	28	6	4	2	127
	Total =	166	27	8	6	490

¹Regions "A", "C", "D", "J", "L", "P", "R"

²Includes Region "G"

³Includes Region "M", "O"

⁴Includes Region "U"

⁵Includes Region "F"

Laboratory Precision and Accuracy

In order to assess the quality of the data, relative percent difference calculations on the relative percent difference (RPD) for each sample split, duplicate, or "reference" sample is presented in this section. The RPD for each sample was calculating using the following formula:

$$\text{Relative Percent Difference (RPD)} = ((A-B)/(A+B))/2 \times 100 = (\%)$$

For example, sample "A" has a value of 16 mg/kg. Sample "B," which is a duplicate, has a value of 13.9 mg/kg. The RPD in this case is:

$$\text{RPD} = ((16-13.9)/(16+13.9))/2 \times 100 = 3.5\%$$

RPD values were not calculated if a laboratory detection limit value was reported for one or both samples.

Data Quality Results

RPD calculations for each sample split, duplicate, or reference sample is given in Table 18. The overall quality of the data was excellent-- the average relative percent difference for all sample splits, duplicates, or reference samples was 4%. The median relative percent difference value for each of the 12 elements was less than 6%. The RPD values were highest for the two elements cadmium and mercury. This variance can probably be attributed to the presence of both elements at concentrations that are at or near laboratory detection limits.

Analytical Effects - Arsenic

During the compilation of data for this study, it was noted that at lower levels (i.e., less than 50 mg/kg), the arsenic values produced by inductively coupled plasma atomic emission spectroscopy (ICP) were significantly higher than those produced by atomic absorption (AA). The effect of AA vs. ICP upon the Puget Sound Basin, Spokane, Clark County, and Yakima Basin data sets is graphically illustrated in Figures 49-52. ICP analysis can produce higher values for arsenic because of iron (iron acts as an interferant and is difficult to correct for when analyzing for arsenic using ICP methods). In contrast to ICP, AA analysis has a much lower detection limit (when analyzing for arsenic in soil, the Ecology Manchester Laboratory uses a detection limit of 0.15 mg/kg for GFAA and 3 mg/kg for ICP analysis) and is thus much more accurate than ICP at lower levels. Thus, it is important to be aware of this issue when analyzing for arsenic.

Quality Assurance Memos

Information on sample receipt, instrument calibrations, procedural blanks, spiked samples, and serial dilutions were summarized in "quality assurance" memos prepared by Manchester laboratory. An example quality assurance memo is included on p. 12-12.

TABLE 19: RELATIVE PERCENT DIFFERENCE SUMMARY STATISTICS (PER ELEMENT)

	Al	As - AA	As - ICP	Be	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Zn
MAX	11.9%	50.0%	28.3%	12.3%	30.9%	9.1%	21.0%	15.2%	18.9%	16.0%	38.9%	13.1%	6.0%
MEAN	2.7%	5.6%	6.9%	2.4%	7.5%	2.1%	3.1%	1.9%	5.3%	3.3%	8.2%	2.7%	1.4%
MEDIAN	1.9%	2.1%	6.0%	1.6%	5.9%	1.6%	1.2%	1.3%	3.3%	2.4%	5.0%	2.0%	0.9%
MIN	0.0%	0.0%	0.0%	0.0%	0.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
(n) =	38	31	33	37	24	38	38	38	33	38	36	38	38

FIGURE 48: MEAN RELATIVE PERCENT DIFFERENCE PER ELEMENT

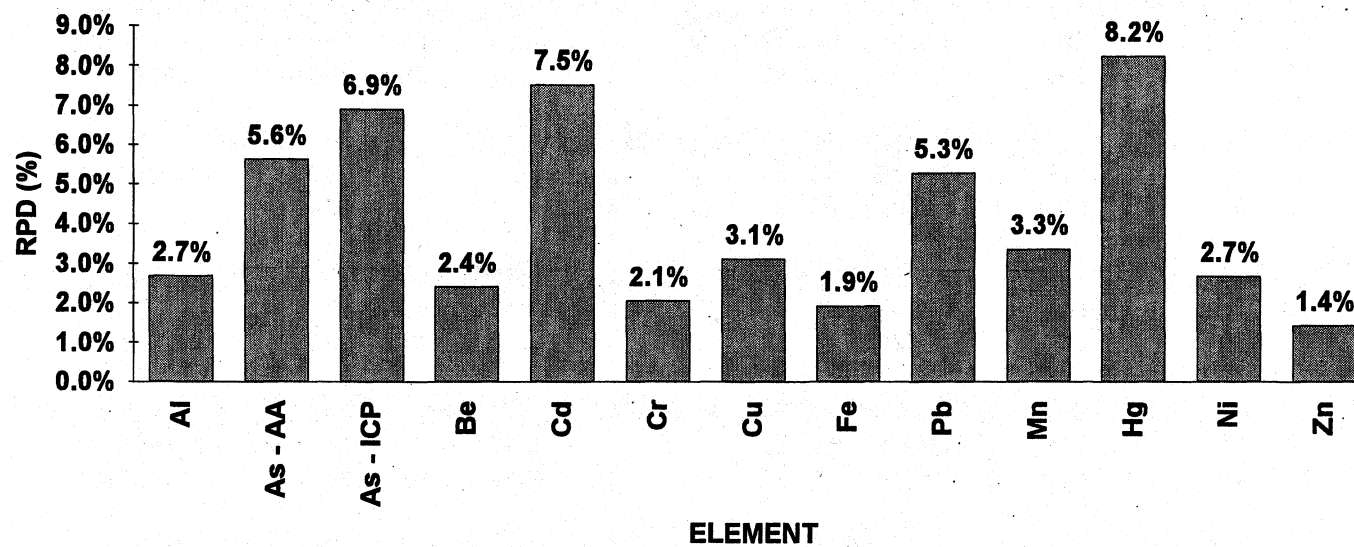


TABLE 20: RELATIVE PERCENT DIFFERENCES, SAMPLE SPLITS, DUPLICATES, AND REFERENCE SAMPLES

SITE	SAMPLE NO.	Al	As - AA	As - ICP	Be	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Zn	MEAN RPD (%)
CL112.2	91238180	32,400	3.31	22.0	1	1	26	15	33,500	8	562	0	17	64	
CL312.2.3SS	91258446	30,400			1	1	23	14	34,100	4	827	0	15	57	
	RPD =	2%			1%	7%	2%	2%	0%	19%	10%	7%	2%	3%	5%
CL140.3	91238185	25,600	3.89	22.0	2	1	19	23	34,300	54	536	0	12	80	
CL280.3SS	91238209	25,400	4.95	48.9	2	1	21	56	39,200	25	529	0	13	78	
	RPD =	0%	6%	19%	1%	13%	2%	21%	3%	19%	0%	39%	2%	0%	10%
CL150.3	91238187	53,500	2.64	38.3	2	1	29	22	48,800	10	434	0	21	74	
CL282.2SS	91238210	42,500	3.35	59.3	2	1	26	22	46,200	8	420	0	14	64	
	RPD =	6%	6%	11%	2%	2%	3%	0%	1%	6%	1%	7%	0%	4%	4%
CL182.2	91258505	45,100	3.14	37.1	2	1	31	18	37,500	11	1370	0	19	89	
CL292.2SS	91258510	44,700	2.90	31.9	1	1	29	18	37,600	7	1310	0	20	87	
	RPD =	0%	2%	4%	0%	3%	1%	0%	0%	10%	1%	0%	1%	1%	2%
CL240.3		38,800			2	1	17	20	52,900	10	986	0	19	99	
CL300.3SS	91258447	37,700			2	1	18	20	52,100	9	1100	0	17	99	
	RPD =	1%			4%	9%	2%	1%	0%	2%	3%	5%	3%	0%	3%
CL270.3RS	91258520	19,200	2.80	18.0	1	1	25	10	16,500	5	258	0	26	29	
CL272.2RS	91258521	19,500	2.70	15.0	1	0	24	10	16,500	4	247	0	28	30	
	RPD =	0%	1%	5%	2%	7%	0%	1%	0%	7%	1%	1%	2%	1%	2%
PSL3A0.5	87278105	22,800		18	1	<.8	19	18	15,300	<4	373	0	21	40	
PSL5A0.5DUP	91258522	21,800		19	1	<.8	19	27	17,000	<4	412	0	21	42	
	RPD =	1%		1%	0%		0%	10%	3%		2%	1%	0%	1%	2%
PSL6A0.5	87278111	15,700		<11	1	<.8	26	13	14,200	<4	231	0	25	31	
PSB8A0.5DUP	87278147	14,500		<11	<.5	8	18	10	13,500	<4	215	0	22	28	
	RPD =	2%					9%	7%	1%		2%	7%	3%	3%	4%
PSB2A0.5	87278113	21,900		12	1	<.8	24	13	17,000	<4	494	0	23	39	
PSB6A0.5DUP	87278145	23,000		<11	1	<.8	22	12	17,000	<4	255	0	23	39	
	RPD =	1%			3%		2%	2%	0%		16%	6%	0%	0%	3%
PSB4A2.0	87278142	28,300		15	1	<.8	24	8	11,300	<4	137	0	19	27	
PSB7A2.0DUP	87278146	25,000		<11	1	<.8	20	8	10,300	<4	122	0	16	26	
	RPD =	3%			5%		5%	0%	2%		3%	1%	4%	1%	3%

TABLE 20: RELATIVE PERCENT DIFFERENCES, SAMPLE SPLITS, DUPLICATES, AND REFERENCE SAMPLES

SITE	SAMPLE NO.	Al	As - AA	As - ICP	Be	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Zn	MEAN RPD (%)
PS10.3	93088519	24,000	7	27	1	1	34	32	28,700	16	1210	0	30	60	
PS300.3DUP	93088637	21,000	6	20	1	<0.2	31	29	27,400	13	1090	0	25	55	
	RPD =	3%	4%	7%	2%		2%	3%	1%	5%	3%	2%	4%	2%	3%
PS12.2	93088520	21,700	6	20	0	1	36	30	27,300	6	819	0	30	44	
PS302.2DUP	93088638	16,700	6	19	0	<0.2	33	25	25,500	6	972	0	23	41	
	RPD =	7%	1%	1%	1%		2%	4%	2%	1%	4%	3%	7%	2%	3%
PS20.3	93088522	14,600	3	15	0	0	20	16	17,700	7	654	0	21	65	
PS270.3DUP	93088631	13,400	2	12	0	<0.2	18	15	15,800	6	637	0	18	65	
	RPD =	2%	5%	6%	1%		2%	1%	3%	1%	1%	7%	5%	0%	3%
RPD =															
PS22.2	93088523	17,300	6	23	0	1	31	16	28,200	5	459	0	23	45	
PS272.2DUP	93088632	11,400	4	17	0	<0.2	22	10	20,400	4	342	0	13	35	
	RPD =	10%	11%	8%	12%		8%	10%	8%	6%	7%	6%	13%	6%	9%
PS40.3V	93088527	20,600	9	28	0	1	48	40	36,600	18	663	0	54	109	
PS320.3SS	93088641	19,700	10	31	0	0	45	39	33,400	16	586	0	48	100	
	RPD =	1%	3%	2%	1%	31%	1%	0%	2%	3%	3%	2%	3%	2%	4%
PS70.3C	93088552	10,400	4	10	0	0	19	16	16,400	8	315	0	18	43	
PS310.3SS	93088639	10,300	5	13	0	<0.2	20	18	15,900	10	316	0	17	45	
	RPD =	0%	1%	7%	3%		2%	2%	1%	5%	0%	7%	1%	1%	2%
PS122.2	93088578	18,800	2	8	0	<0.2	24	11	16,200	5	172	0	27	27	
PS292.2SS	93088636	14,500	2	10	0	<0.2	25	9	13,000	3	138	0	26	23	
	RPD =	6%	2%	6%	1%		1%	4%	5%	14%	5%	10%	1%	4%	5%
PS154.3V	93088588	17,300	3	4	0	<0.2	16	19	18,000	4	227	0	19	36	
PS312.2SS	93088640	18,400	2	13	0	<0.2	18	18	18,200	3	249	0	21	35	
	RPD =	2%	2%	28%	7%		3%	1%	0%	7%	2%	13%	2%	1%	6%
PS282.2SS	93088634	23,400	4	20	0	<0.2	23	14	27,800	7	287	0	15	54	
PS1855	93088603	14,400	2	14	0	<0.2	22	22	25,200	8	217	0	15	50	
	RPD =	12%	20%	9%	10%		1%	12%	2%	1%	7%	10%	1%	2%	7%
PS200.3A	93088612	12,900	14	26	0	0	24	16	12,300	46	621	0	27	49	
PS290.3SS	93088635	13,300	6	19	0	0	19	15	11,400	42	519	0	27	48	

TABLE 20: RELATIVE PERCENT DIFFERENCES, SAMPLE SPLITS, DUPLICATES, AND REFERENCE SAMPLES

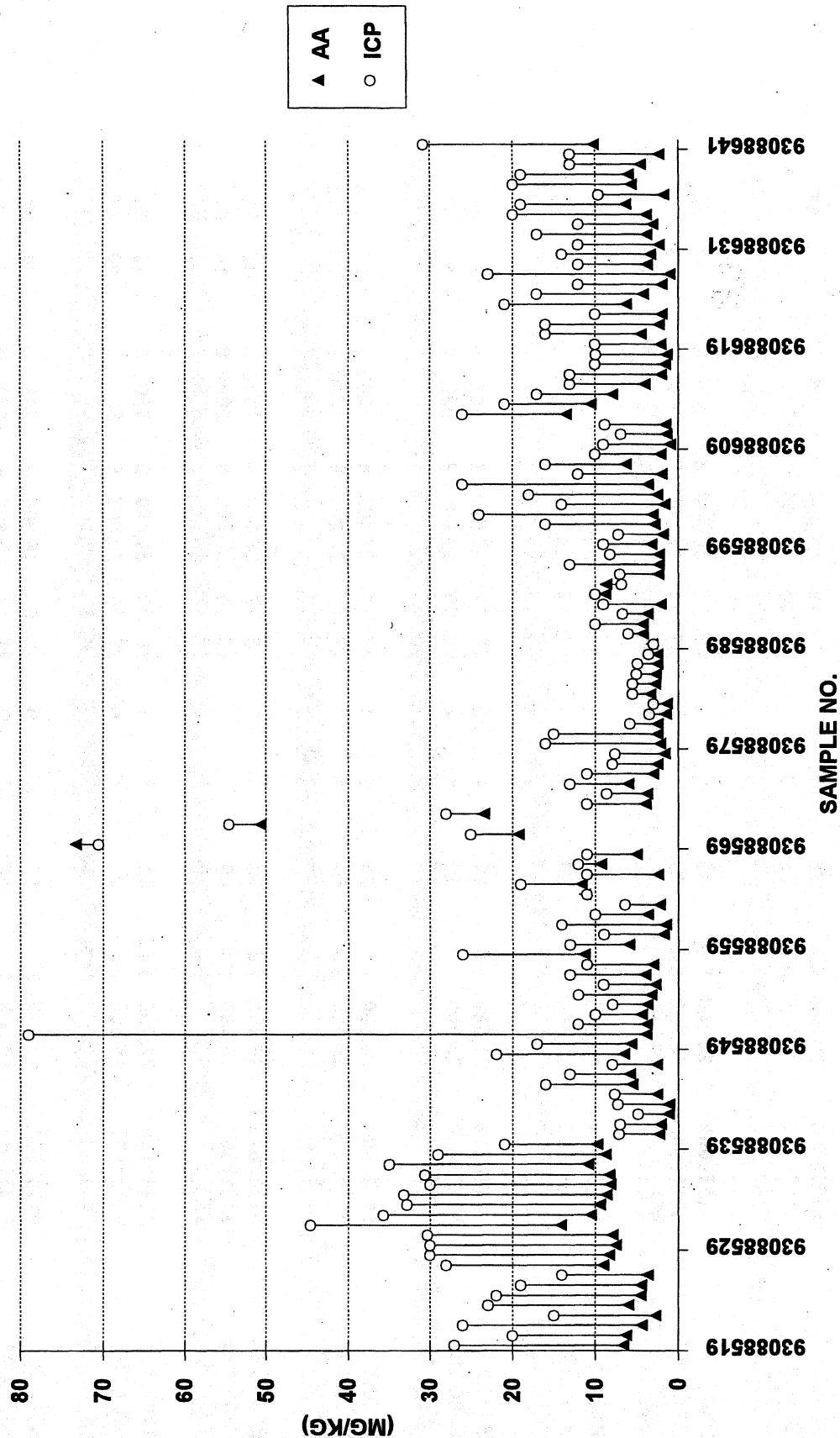
SITE	SAMPLE NO.	Al	As - AA	As - ICP	Be	Gd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Zn	MEAN RPD (%)
	RPD =	1%	18%	8%	0%	2%	6%	1%	2%	2%	4%	5%	0%	0%	4%
PS260.3RS	93088629	9,330	4	12	0	<0.2	9	17	21,900	6	420	0	11	48	
PS262.2RS	93088630	8,610	3	14	0	<0.2	9	16	21,400	6	402	0	10	48	
	RPD =	2%	3%	4%	1%	1%	0%	1%	0%	0%	1%	2%	4%	0%	2%
SB10.3	92268500	9,070	3.59	7.8	0	1	7	14	15,700	8	364	0	7	47	
SB330.3SS	92268574	9,570	3.15	12.0	0	0	7	13	16,500	8	353	0	8	50	
	RPD =	1%	3%	11%	1%	4%	2%	2%	1%	1%	1%	0%	1%	1%	2%
SB12.2	92268501	7,940	5.22	8.7	0	0	6	15	19,400	5	369	0	8	42	
SB320.3SS	92268573	9,155	4.15	12.0	0	1	6	15	22,000	6	378	0	10	46	
	RPD =	4%	6%	8%	5%	10%	2%	0%	3%	3%	1%	33%	5%	2%	6%
SB20.3	92268502	15,800	3.92	10.0	1	0	7	15	14,600	15	443	0	8	55	
SB340.3SS	92268575	17,100	3.72	15.0	1	0	8	14	15,400	15	435	0	9	56	
	RPD =	2%	1%	10%	2%	5%	1%	1%	1%	0%	0%	5%	1%	0%	2%
SB32.2	92268505	14,500	9.87	17.0	1	1	10	14	22,900	13	526	0	10	54	
SB270.3 SS	92268568	17,600	9.92	24.0	1	1	11	15	24,500	14	520	<0.005	11	59	
	RPD =	5%	0%	9%	2%	3%	3%	1%	2%	2%	0%		1%	2%	2%
SB60.3	92268511	12,200	3.21	9.7	1	0	11	7	13,200	10	730	0	11	59	
SB290.3SS	92268570	14,500	3.03	15.0	1	0	11	8	14,300	10	1170	0	12	66	
	RPD =	4%	1%	11%	3%	18%	1%	3%	2%	1%	12%	0%	2%	3%	5%
SB80.3	92268517	15,500	5.82	17.0	1	1	11	12	13,400	17	488	0	9	56	
SB310.3SS	92268572	16,000	5.90	14.0	1	1	11	12	13,400	18	452	0	10	57	
	RPD =	1%	0%	5%	3%	1%	1%	0%	0%	1%	2%	4%	3%	0%	2%
SB111.3	92268525	18,800	7.95	20.0	1	1	13	19	37,800	12	777	0	13	60	
SB350.3SS	92268576	15,900	8.27	19.0	1	1	13	36	20,200	15	456	0	13	59	
	RPD =	4%	1%	1%	1%	3%	0%	15%	15%	6%	13%	24%	1%	0%	7%
SB130.3	92268529	24,200	3.46	19.0	1	1	19	17	22,300	10	550	0	16	52	
SB300.3SS	92268571	23,900	2.30	13.0	1	0	18	17	21,800	12	656	0	15	52	
	RPD =	0%	10%	9%	0%	10%	1%	1%	1%	5%	4%	1%	1%	0%	3%
SB142.2V	92268536	13,800	2.30	14.0	1	0	11	17	13,100	8	381	0	10	38	

TABLE 20: RELATIVE PERCENT DIFFERENCES, SAMPLE SPLITS, DUPLICATES, AND REFERENCE SAMPLES

SITE	SAMPLE NO.	Al	As - AA	As - ICP	Be	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Zn	MEAN RPD (%)
SB280.3SS	92268569	14,800	2.40	11.0	1	0	11	17	14,200	11	397	<0.005	11	44	
	RPD =	2%	1%	6%	2%	8%	1%	0%	2%	7%	1%		2%	4%	3%
YB50.3V	91258574	14,200	4.6	26	1	0	13	18	25,400	11	465	0	13	55	
YB340.3SS	91258582	13,700	4.4	29	1	1	13	18	25,100	11	470	0	15	56	
	RPD =	1%	1%	3%	0%	13%	1%	1%	0%	0%	0%	1%	4%	0%	2%
YB60.3	91258562	23,000	5.4	33	1	0	29	23	35,600	8	875	0	37	73	
YB332.2SS	91258569	26,000	5.4	33	1	1	32	24	37,400	7	876	0	38	79	
	RPD =	3%	0%	0%	1%	4%	2%	1%	1%	3%	0%	1%	1%	2%	1%
YB90.3C	91258578	23,700	1.7	33	1	1	13	17	34,900	<2	1350	0	13	51	
YB342.2SS	91258583	23,500	1.8	30	1	1	11	18	34,900	2	1160	0	12	50	
		0%	1%	2%	0%	14%	3%	1%	0%		4%	5%	3%	0%	3%
YB110.3	91258544	21,000	1.5	20	1	0	11	17	20,900	5	501	0	9	44	
YB360.3SS	91258412	24,200		20	1	0	12	20	22,000	3	397	0	11	39	
	RPD =	4%		0%	5%	1%	0%	3%	1%	11%	6%	29%	5%	3%	6%
YB130.3	91258404	28,100		23	1	1	27	16	27,100	5	1250	0	35	113	
YB350.3SS	91258408	26,100	2.9	40	1	1	27	17	27,200	8	1540	0	35	115	
	RPD =	2%	50%	13%	2%	3%	0%	1%	0%	11%	5%	39%	0%	0%	10%
YB140.6V	91258546	18,400	1.5	34	1	1	15	17	38,000	5	1600	0	15	62	
YB330.3SS	91258551	18,400	1.3	30	1	1	15	16	35,900	4	2000	0	16	61	
	RPD =	0%	4%	3%	1%	7%	1%	1%	1%	3%	6%	4%	3%	0%	3%
YB160.3	91258406	24,200	3.12	35	1	1	29	19	20,400	5	539	0	23	45	
YB352.2SS	91258409	19,800	2.1	21	1	<0.2	28	16	20,000	8	554	0	22	44	
	RPD =	5%	10%	13%	3%		1%	3%	0%	13%	1%	3%	1%	0%	4%
YB370.3RS	91258444	18,100	3	17	1	0	25	9	16,000	4	265	0	26	30	
YB372.2RS	91258445	19,500	3	17	1	0	27	10	16,900	4	273	0	27	31	
	RPD =	2%	0%	0%	1%	1%	1%	1%	1%	0%	1%	2%	1%	1%	1%
MEAN RELATIVE PERCENT DIFFERENCE (ALL SAMPLES) =															4%

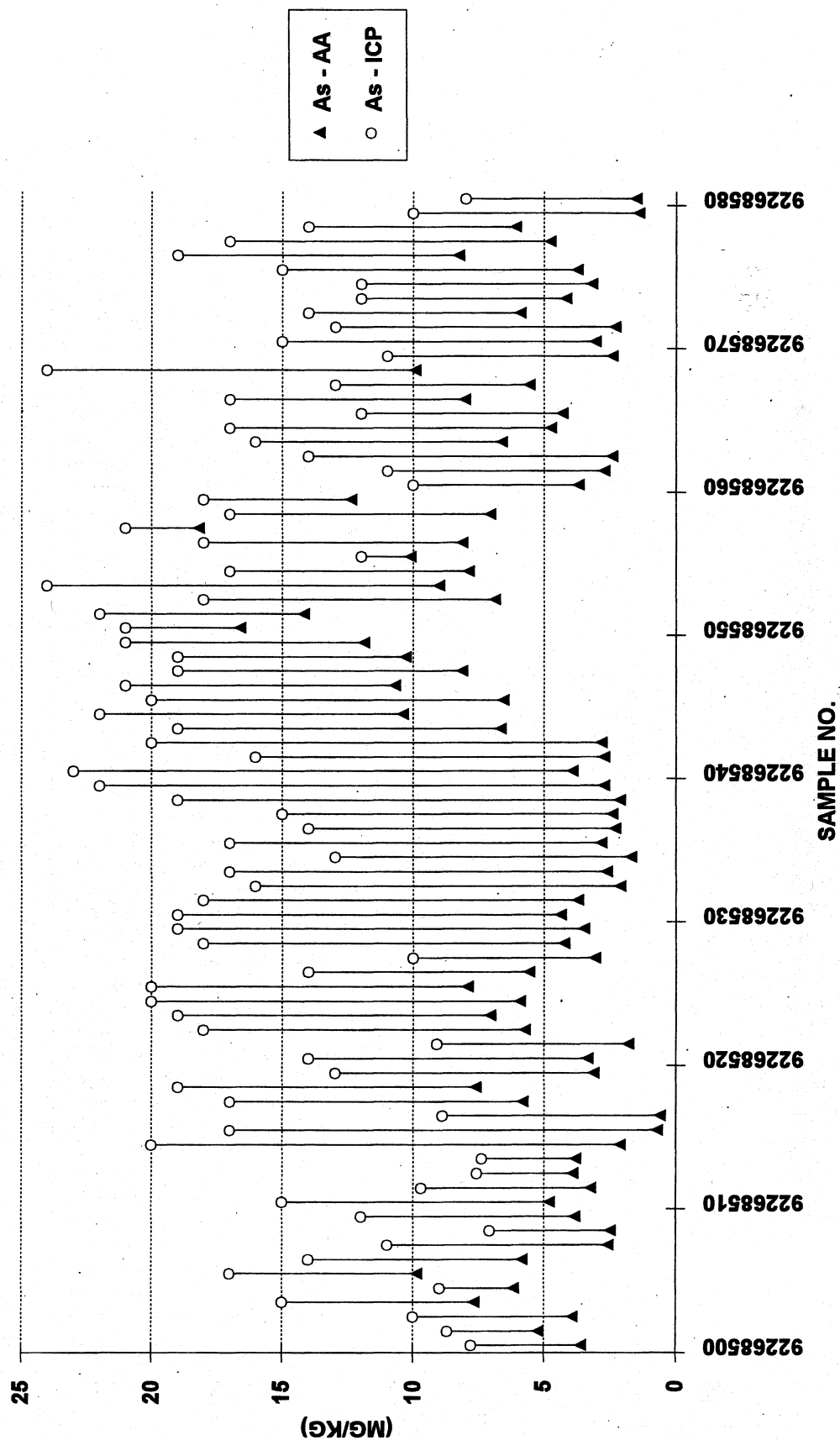
NOTE: CHART BASED ON 121 SAMPLES COLLECTED DURING 1993.

FIGURE 49: PUGET SOUND BASIN AA vs. ICP ARSENIC SAMPLES



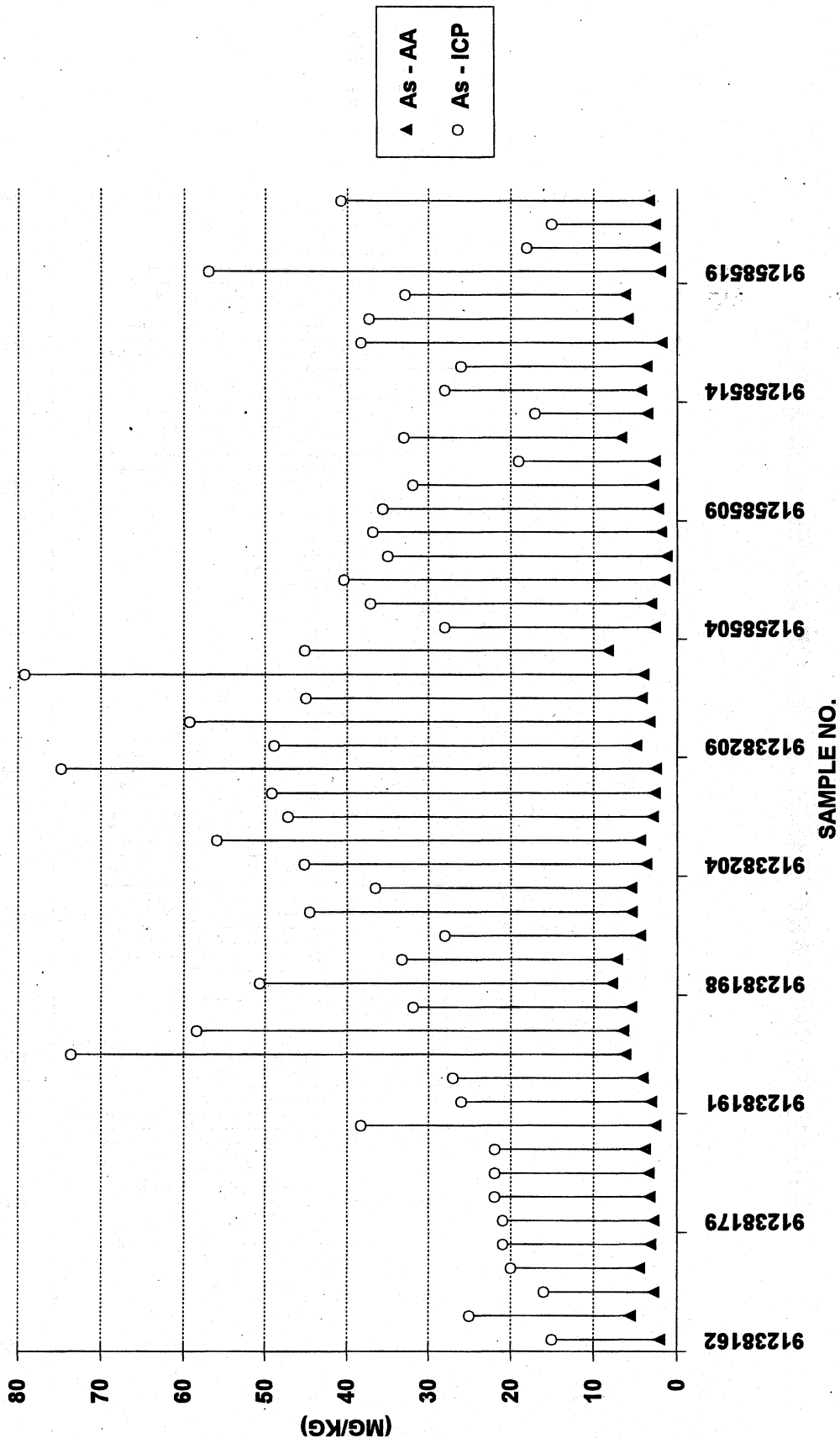
NOTE: CHART BASED ON 81 SAMPLES COLLECTED DURING 1992.

FIGURE 50: SPOKANE BASIN AA vs. ICP ARSENIC SAMPLES



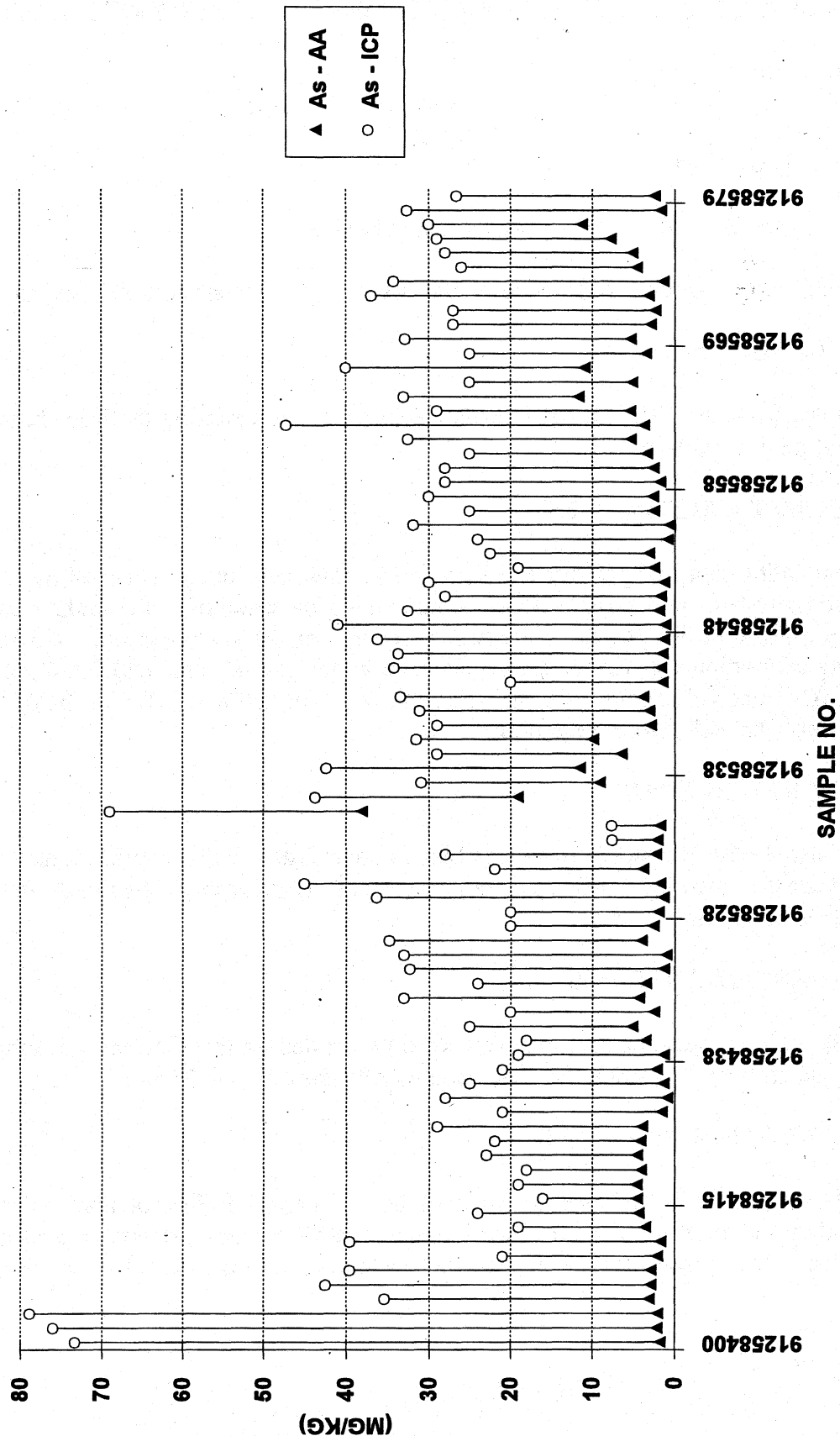
NOTE: CHART BASED ON 49 SAMPLES COLLECTED DURING 1991.

FIGURE 51: CLARK COUNTY AA vs ICP ARSENIC SAMPLES



NOTE: CHART BASED ON 84 SAMPLES COLLECTED DURING 1991.

FIGURE 52: YAKIMA BASIN AA vs. ICP ARSENIC SAMPLES



EXAMPLE QUALITY ASSURANCE MEMO - MANCHESTER LABORATORY

November 1992

TO: Pete Kmet

FROM: Bill Kammin, Environmental_Lab_Director

SUBJECT: Metals Quality Assurance memo for the 1992 Metals in Soils Project

SAMPLE RECEIPT

The samples from the 1992 Metals in Soils project were received by the Manchester Laboratory on 6/18/92 in good condition.

INSTRUMENT CALIBRATION

Instrument calibration was performed before each analytical run and checked by initial calibration verification standards and blanks. Continuing calibration standards and blanks were analyzed at a frequency of 10% during the run and again at the end of the analytical run. All initial and continuing calibration verification standards were within the relevant USEPA Contract Laboratory Program (CLP) control limits. AA calibration gave a correlation coefficient (r) of 0.995 or greater, also meeting CLP calibration requirements.

PROCEDURAL BLANKS

Results flagged with B denote procedural blank contamination. Procedural blank problems were generally at ultra-trace levels. Blank contamination at these levels is commonly found in total recoverable digestions.

SPIKED SAMPLE ANALYSIS

Spike and duplicate spike sample analyses were performed on this data set. Results qualified with N denote spike recoveries outside the CLP acceptance limits of +/- 25%.

SERIAL DILUTION ANALYSES

Serial dilution is used in ICP analyses to examine sample results for potential interferences. Results not meeting CLP serial dilution specifications are qualified with E, denoting sample based interferences. The E qualifier is also used to denote results estimated for other sample based reasons.

SUMMARY AND DISCUSSION

Generally, the quality of the data provided is acceptable. Two representative data packages (one atomic absorption -- one ICP) were examined in exhaustive detail, to help assure project data quality. The detailed analysis of the entire data set for the total recoverable arsenic data showed 96% of all analytical quality control was in control, and 100% of calibration related (critical) QC was in control.

For the ICP data package examined in exhaustive detail (8/6/92 run), calibration blank related critical QC was in control for 132 of 135 (98%) Continuing Calibration Blank (CCB) results. The three results above the Instrument Detection Limit (IDL), are all below 4 ug/L, and are the result of carryover from a standard into the CCB. This carryover has no analytical significance, and results are not qualified as a result of this occurrence.

For ICP Continuing Calibration Verification (CCV) results, 100% of the critical QC data was in control (166/166 results). In addition, for the ICSAB interference check standard, 100% (52/52) of the QC results were in control.

Although the other data sets in this data package were not examined in this exhaustive detail, normal QC review procedures indicate data of similar quality.

The data generated by the analysis of these samples can be used noting the data qualifications discussed in this memo.

Provided as an attachment to this memo is a compilation of qualifier definitions.

Please call Bill Kammin at SCAN 744-4737 to further discuss this project.

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